John Walton.

ENCYCLOPÆDIA BRITANNICA.

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ENCYCLOPÆDIA BRITANNICA.

FORDYCE, DAVID, an elegant and learned writer, was born at Aberdeen in the year 1711. Having received the early part of his education at the grammar school, at the age of 13 he was entered at the Greek class in Marischal college, Aberdeen; in 1728 he took the degree of A. M. and was afterwards, in 1742, admitted professor of philosophy in the same college. He was originally designed for the ministry; to prepare himself for which was the whole object of his ambition, and for a course of years the whole purpose of his studies. How well he was qualified to appear in that character, appears from his "Theodorus, a dialogue concerning the art of preaching." Having finished this work, he went abroad in 1750 on his travels, in order to obtain fresh stores of knowledge: but after a successful tour through several parts of Europe, he was, on his return home, unfortunately cast away in a storm on the coast of Holland, in the 41st year of his age. Besides the above work, he wrote Dialogues on Education, 8vo, and a Treatise of Moral Philosophy, published in the Preceptor. The third edition of his Theodorus was published in London, in 1751, after his death, by his brother James, the subject of the following article.

FORDYCE, *James*, a Scotch divine, justly esteemed for his piety and ingenuity, as well as for his pulpit eloquence, was born at Aberdeen in the year 1720. He received his classical education at the public grammar school, and went afterwards to the Marischal college, where he went through the usnal course of studies necessary for a minister of the gospel. His natural abilities were excellent, and he improved to the utmost the favourable opportunities he enjoyed at the university, which made him be considered as well qualified for a preacher of the gospel at an early period of life. His first appointment was that of second minister in the church of Brechin in the county of Angns, after which he accepted of a call to Alloa near Stirling. The people of that parish were prepossessed in favour of another, and prejudiced against Mr Fordyce, which could not fail to be a most unpleasant circumstance; yet by his impressive delivery, and indefatigable attention to every part of his ministerial duty, he soon changed their prejudice into esteem, and their esteem into admiration.

During his residence at Alloa, he drew on him the notice of the public by three excellent sermons; the first on the eloquence of the pulpit, the second on the method of promoting edification by public institutions, and the third on the delusive and bloody spirit of popery, preached before the synod of Perth and Stirling. But still greater wonder and astonishment were excited by his inimitable sermon on the folly, infamy, and misery of unlawful pleasure, preached before the general assembly of the church of Scotland in 1760. It contains such masterly composition with respect to description, spirit, and elegance, and was delivered with such uncommon solemnity, animation, and pathos, that it filled his learned fathers and brethren with astonishment, and justly raised him to unrivalled eminence among his clerical cotemporaries. About this time he was complimented with a degree of doctor in divinity by the university of Glasgow, probably on account of the fame he acquired by this extraordinary sermon.

The friends of Dr Fordyce being mostly in London, he was invited to that metropolis to be the colleague of Dr Lawrence, minister of a respectable congregation in Monkwell-street, on whose death, which happened a few months after, Dr Fordyce became once more famous for his pulpit eloquence, always preaching to overflowing audiences. This popularity he justly deserved, whether with respect to the elegance of his compositions, or their happy tendency to impress the heart with the love of virtue and religion. Yet even Dr Fordyce lived to see his popularity on the decline; for such as attend a place of worship from mere motives of curiosity must have fickle and unstable minds, changing their preachers as they do their dress, loving to be where others are, of doing what others do, and of admiring what others admire, for they have no taste of their own.

His pews were thinned from another cause, which was the failure of a younger brother, an extensive banker, which ruined many of the doctor's constant hearers and most liberal supporters. Although the doctor could not be reasonably blamed for the failure of his brother, yet it is certain that it brought a degree of odium on the whole family. Another cause of the diminution of his hearers was an unhappy difference between him and Mr Toller his colleague, which happened in the year 1755, and which ended in a division of the congregation, many respectable families following Mr Toller to another place of worship. Soon after this he declined officiating as a minister, the impaired state of his health rendering such a step necessary. The best specimen of pulpit eloquence which perhaps ever came from his pen, was delivered at the ordination

tion of his successor Mr James Lindsay, and highly meriting the attentive perusal of every clergyman. The remainder of his valuable life he spent chiefly at a retirement in Hampshire in the vicinity of the earl of Bute, with whom he lived in the greatest intimacy, and to whose valuable library he had unlimited access. He afterwards went to Bath, where he suffered much from an asthmatic affection, but bore it with the heroic fortitude of a Christian, and expired without a groan on the first of October 1796, in the 76th year of his age.

The doctor's writings discover much genius and imagination, a correct taste, extensive knowledge of the world, and a happy method of engaging the attention; full of ardent piety, and a zeal for the interests of genuine virtue. His religious sentiments were manly and rational; in private life he was highly amiable, and deservedly beloved by all who knew him. He was author of Sermons to Young Women, in two volumes 12mo, which have been translated into several European languages; A Sermon on the Character and Conduct of the Female Sex; Addresses to Young Men, in two volumes 12mo; Addresses to the Deity; A volume of Poems; A discourse on Pain, and Additions to his brother's Temple of Virtue.

FORDYCE, *George*, a writer and lecturer on medicine, was born in the year 1736, and studied at the university of Aberdeen, where he obtained the literary degree of M. A. at the early age of 14, perhaps not altogether owing to the superior cast of his genius, or the extent of his acquirements, which could not be extraordinary in a boy of his years. He became apprentice to an uncle who practised surgery at Uppingham in Rutlandshire, when he was only 15, and afterwards went to the university of Edinburgh, where his diligence and progress attracted the attention of Dr Cullen, at that time professor of chemistry, who very generously promoted his improvement. He graduated in 1758, when only 22 years of age; after which he resided one winter at Leyden. The greater part of his patrimony being spent on his education, he resolved to try his fortune in London, where he settled in the year 1759. He commenced with a course of lectures on chemistry; and although his encouragement at first was by no means flattering, yet he steadily and diligently persevered, notwithstanding such unfavourable appearances, till his literary merit began gradually to be discovered and properly appreciated. A number of young men who came to study in London did not think that their medical course was complete, without availing themselves of the benefit of his course of lectures.

In the year 1768, he published his Elements of the Practice of Physic, which formed the text book of his medical course, and were much read as a valuable epitome of medicine. His private practice was very respectable; and in the year 1770 his medical reputation was so great, that he was chosen physician to the hospital of St Thomas, although he had to contend against a gentleman with very powerful interest; and his merit as a man of science made him a member of the Royal Society in 1776. He was chosen in 1787 a fellow of the College of Physicians; and his chemical knowledge was of singular importance to that body for a new edition of their Pharmacopœia. By the influence of his connections, but probably more so by his literary reputation, he was appointed to furnish the navy with sour-krout, which we believe he executed with advantage both to himself and the public.

His constitution discovered symptoms of premature decay, yet he continued to discharge his professional duties till he fell a victim to an irregular gout, and a water in his chest, on the 25th of June 1802, in the 66th year of his age. If his lectures wanted the charms of an eloquent delivery, he made ample compensation by the originality of his ideas and his scientific information, and by a memory which was uncommonly retentive. His works are, Elements of Agriculture and Vegetation; Of the Practice of Physic; A Treatise on the Digestion of Food; and Four Dissertations on Fever.

FORE, applied to a ship, denotes all that part of a ship's frame and machinery which lies near the stem.

Fore and aft, is used for the whole ship's length, or from end to end.

FORECASTLE *of a Ship*, that part where the foremast stands. It is divided from the rest by a bulkhead.

FOREIGN, something extraneous, or that comes from abroad. The word is formed from the Latin *fores*, "doors;" or *foris*, "out of doors;" or *forum*, "market," &c.

Foreign minister, foreign prince, foreign goods, &c. are those belonging to other nations. See MINISTER, &c.

Foreign to the purpose, signifies a thing remote or impertinent.

FOREIGN, in the *English Law*, is used in various significations. Thus,

Foreign Attachment, is an attachment of the goods of foreigners found within a city or liberty, for the satisfaction of some citizen to whom the foreigner is indebted; or it signifies an attachment of a foreigner's money in the hands of another person.

Foreign Kingdom, a kingdom under the dominion of a foreign prince.

At the instance of an ambassador or consul, any offender against the laws here may be sent for hither from a foreign kingdom to which he hath fled. And, where a stranger of Holland, or any foreign country, buys goods at London, for instance, and there gives a note under his hand for payment, and then goes away privately into Holland; in that case, the seller may have a certificate from the lord mayor, on the proof of the sale and delivery of such goods, whereupon a process will be executed on the party in Holland.

Foreign Opposer, or *Apposer*, an officer in the exchequer that opposes or makes a charge on all sheriffs, &c. of their green wax; that is to say, fines, issues, amerciaments, recognizances, &c.

Foreign Plea, signifies an objection to the judge of the court, by refusing him as incompetent, because the matter in question is not within his jurisdiction.

Foreign Seamen, serving two years on board British ships, whether of war, trade, or privateers, during the time of war, shall be deemed natural-born subjects.

FOREIGNER, the natural-born subject to some foreign prince.

Foreigners, though made denizens, or naturalized, are, Foreigner ‖ Fore-locks

are disabled to bear any office in government, to be of the privy council, or members of parliament, &c.—This is by the acts of the settlement of the crown.—Such persons as are not freemen of a city or corporation, are also called *foreigners*, to distinguish them from the members of the same.

FOREJUDGER, in *Law*, signifies a judgment whereby one is deprived or put by a thing in question.

To be *forejudged the court*, is where an officer or attorney of any court is expelled the same for malpractice, or for not appearing to an action on a bill filed against him, &c. And where an attorney of the common-pleas is sued, the plaintiff's attorney delivers the bill to one of the criers of the court, who calls the attorney defendant, and solemnly proclaims aloud, that, if he does not appear thereto, he will be forejudged: likewise a rule is given by the secondary for his appearance; and if the attorney appears not in four days, then the clerk of the warrants strikes such an attorney off the roll of attorneys; after which he becomes liable to be arrested like any other person; but where an attorney is forejudged, he may be restored on clearing himself from his contumacy, and making satisfaction to the plaintiff, &c.

FORELAND, or FORENESS, in *Navigation*, a point of land jutting out into the sea.

North FORELAND, in the isle of Thanet, Kent, of which it is the N. E. point, is the promontory ascertained by act of parliament to be the most southern part of the port of London, which is thereby extended N. in a right line to the point called the Nase on the coast of Essex, and forms what is properly called the Mouth of the Thames. A sea-mark was erected here by the Trinity-house corporation at the public expence, which is a round brick tower, near 80 feet high. The sea gains so much upon the land here by the winds at S. W. that within the memory of some that are living about 30 acres of land have been lost in one place. All vessels that pass on the south side of this head-land are said to enter the Channel, which is the name for the narrow sea between England and France; and all the towns or harbours between London and this place, whether on the Kentish or Essex shore, are called members of the port of London.

South FORELAND, in Kent, a head-land forming the east point of the Kentish shore; and called *South*, in respect to its bearing from the other Foreland, which is about six miles to the north. Its situation is of great security to the Downs, the road between both, which would be a very dangerous road for ships, did not this point break the sea off, that would otherwise come rolling up from the west to the Flats or banks of sand, which for three leagues together, and at about a league or a league and a half from the shore, run parallel with it, and are dry at low water; so that these two capes breaking all the force of the sea on the S. E. and S. W. make the Downs accounted a good road, except when the wind blows excessively hard from S. E., E. by N., or E. N. E., when ships in the Downs are driven from their anchors, and often run ashore, or are forced on the sands, or into Sandwich bay or Ramsgate pier.

FORE-LOCKS, in the sea language, little flat wedges made of iron, used at the end of bolts, to keep them from flying out of their holes.

Foremast, Forest.

FOREMAST of a SHIP, a large round piece of timber, placed in her fore part or fore-castle, and carrying the fore-sail and fore-top-sail yards. Its length is usually $\frac{8}{9}$ of the main mast, and the fore-top-gallant mast is $\frac{1}{2}$ the length of the fore-top.

FOREMAST-Men, are those on board a ship that take in the top-sails, sling the yards, furl the sails, howse, trice, and take their turn at the helm, &c.

FOREST, in *Geography*, a huge wood; or, a large extent of ground covered with trees. The word is formed of the Latin *foresta*, which first occurs in the capitulars of Charlemagne, and which itself is derived from the German *frost*, signifying the same thing. Spelman derives it from the Latin *foris restat*, by reason forests are out of towns. Others derive *foresta* from *feris*, q. d. *Foresta, quod sit tuta statio ferarum*, as being a safe station or abode for wild beasts.

The Caledonian and Hercynian forests are famous in history. The first was a celebrated retreat of the ancient Picts and Scots: the latter anciently occupied the greatest part of Europe; particularly Germany, Poland, Hungary, &c. In Cæsar's time it extended from the borders of Alsatia and Switzerland to Transylvania; and was computed 60 days journey long, and 9 broad: some parts or cantons thereof are still remaining.

The ancients adored forests, and imagined a great part of their gods to reside therein: temples were frequently built in the thickest forests; the gloom and silence whereof naturally inspire sentiments of devotion, and turn men's thoughts within themselves.

For the like reason, the Druids made forests the place of their residence, performed their sacrifices, instructed their youth and gave laws therein.

FOREST, in *Law*, is defined, by Manwood, a certain territory of woody grounds and fruitful pastures, privileged for wild beasts and fowls of forest, chase, and warren, to rest and abide under the protection of the king, for his princely delight; bounded with unremoveable marks and meres, either known by matter of record or prescription; replenished with wild beasts of venery or chase, with great coverts of vert for the said beasts; for preservation and continuance whereof, the vert and venison, there are certain particular laws, privileges, and officers.

Forests are of such antiquity in England, that, excepting the New Forest in Hampshire, erected by William the Conqueror, and Hampton Court, erected by Henry VIII. it is said, that there is no record or history which makes any certain mention of their erection, though they are mentioned by several writers and in several of our laws and statutes. Ancient historians tell us, "that New forest was raised by the destruction of 22 parish churches, and many villages, chapels, and manors, for the space of 30 miles together, which was attended with divers judgments on the posterity of William I. who erected it: for William Rufus was there shot with an arrow, and before him Richard the brother of Henry I.; and Henry nephew to Robert, the eldest son of the Conqueror, did hang by the hair of the head in the boughs of the forest, like unto Absalom." *Blount.*

Besides the New forest, there are 68 other forests in England, 13 chases, and more than 700 parks: the four principal forests are New forest on the sea, Shire-

Forest. wood forest on the Trent, Dean forest on the Severn, and Windsor forest on the Thames.

A forest in the hands of a subject is properly the same thing with a CHASE; being subject to the common law, and not to the forest laws. But a chase differs from a forest in that it is not enclosed: and likewise, that a man may have a chase in another man's ground as well as his own; being indeed the liberty of keeping beasts of chase, or royal game therein, protected even from the owner of the land, with a power of hunting them thereon. See PARK.

The manner of erecting a forest is thus: Certain commissioners are appointed under the great seal, who view the ground intended for a forest, and fence it round; this commission being returned into chancery, the king causeth it to be proclaimed throughout the country where the land lieth, that it is a forest; and prohibits all persons from hunting there, without his leave. Though the king may erect a forest on his own ground and waste, he may not do it on the ground of other persons without their consent; and agreements with them for that purpose ought to be confirmed by parliament.

A forest, strictly taken, cannot be in the hands of any but the king; for no person but the king has power to grant a commission to be justice in eyre of the forest: yet, if he grants a forest to a subject, and that on request made in the chancery, that subject and his heirs shall have justices of the forest, in which case the subject has a forest in law.

A second property of a forest is, the courts thereof. See *FOREST Courts, infra.*

A third property is the officers belonging to it, as the justices, warden, verderer, forester, agistor, regarder, keeper, bailiff, beadle, &c. See the articles AGISTOR, BAILIFF, FORESTER, &c.

By the laws of the forest, the receivers of trespasses in hunting, or killing of the deer, if they know them to be the king's property, are principal trespassers. Likewise, if a trespass be committed in a forest, and the trespasser dies, after his death it may be punished in the lifetime of the heir, contrary to common law. Our Norman kings punished such as killed deer in any of their forests with great severity; also in various manners; as by hanging, loss of limbs, gelding, and putting out eyes. By *magna charta de foresta*, it is ordained, that no person shall lose life or member for killing the king's deer in forests, but shall be fined; and if the offender has nothing to pay the fine, he shall be imprisoned a year and a day, and then be delivered, if he can give security not to offend for the future, &c. 9 Hen. III. c. 1.

Before this statute, it was felony to hunt the king's deer; and by a late act, persons armed and disguised, appearing in any forest, &c. if they hunt, kill, or steal any deer, &c. are guilty of felony. 9 Geo. I. c. 22.

He who has any license to hunt in a forest or chase, &c. is to take care that he does not exceed his authority; otherwise he shall be deemed a trespasser from the beginning, and be punished for that fact, as if he had no license. See further, the articles GAME, and *Game-Law.*

Beasts of the forest are, the hart, hind, buck, doe, boar, wolf, fox, hare, &c. The seasons for hunting whereof are as follow, viz. that of the hart and buck begins at the feast of St John Baptist, and ends at Holy-rood-day; of the hind and doe, begins at Holy rood, and continues till Candlemas; of the boar, from Christmas to Candlemas; of the fox, begins at Christmas, and continues till Lady-day; of the hare at Michaelmas, and lasts till Candlemas.

Forest. *FOREST-courts*, courts instituted for the government of the king's forests in different parts of the kingdom, and for the punishment of all injuries done to the king's deer or venison, to the vert or greensward, and to the covert in which such deer are lodged. These are the courts of ATTACHMENTS, of REGARD, of SWEINMOTE, and of JUSTICE-SEAT. 1. The court of attachments, woodmote, or forty days court, is to be held before the verderers of the forest once in every forty days; and is instituted to inquire into all offenders against vert and venison: who may be attached by their bodies, if taken with the mainour (or *mainœuvre, à manu*) that is, in the very act of killing venison, or stealing wood, or in the preparing so to do, or by fresh and immediate pursuit after the act is done; else they must be attached by their goods. And in this forty-days court the foresters or keepers are to bring in their attachments, or presentments *de viridi et venatione*; and the verderers are to receive the same, and to enrol them, and to certify them nnder their seals to the court of justice-seat or sweinmote: for this court can only inquire of, but not convict, offenders. 2. The court of regard, or survey of dogs, is to be holden every third year for the lawing or expeditation of mastiffs; which is done by cutting off the claws of the fore feet, to prevent them from running after deer. No other dogs but mastiffs are to be thus lawed or expeditated, for none other were permitted to be kept within the precincts of the forest; it being supposed that the keeping of these, and these only, was necessary for the defence of a man's house. 3. The court of sweinmote is to be holden before the verderers, as judges, by the steward of the sweinmote, thrice in every year; the sweins or freeholders within the forest composing the jury. The principal jurisdiction of this court is, first, to inquire into the oppressions and grievances committed by the officers of the forest; "*de super-oneratione forestariorum, et aliorúm ministrorum forestæ; et de eorum oppressionibus populo regis illatis;*" and, secondly to receive and try presentments certified from the conrt of attachments against offences in vert and venison. And this court may not only inquire, but convict also; which conviction shall be certified to the court of justice-seat under the seals of the jury, for this court cannot proceed to judgment. But the principal court is, 4. The court of justice-seat, which is held before the chief justice in eyre, or chief itinerant judge, *capitalis justiciarius in itinere*, or his deputy; to hear and determine all trespasses within the forest, and all claimes of franchises, liberties, and privileges, and all pleas and causes whatsoever therein arising. It may also proceed to try presentments in the inferior courts of the forests, and to give judgment upon conviction of the sweinmote. And the chief justice may therefore, after presentment made or indictment found, but not before, issue his warrant to the officers of the forest to apprehend the offenders. It may be held every third year; and 40 days notice ought to be given of its sitting. This court may

may fine and imprison for offences within the forest, it being a court of record: and therefore a writ of error lies from hence to the court of king's bench, to rectify and redress any mal-administrations of justice; or the chief justice in eyre may adjourn any matter of law into the court of king's bench.

Forest-Laws, are peculiar laws, different from the common law of England. Before the making of *Charta de Foresta*, in the time of King John and his son Henry III. confirmed in parliament by 9 Henry III. offences committed therein were punished at the pleasure of the king in the severest manner. By this charter, many forests were disafforested and stripped of their oppressive privileges, and regulations were made for the government of those that remained; particularly, killing the king's deer was made no longer a capital offence, but only punished by fine, imprisonment, or abjuration of the realm: yet even in the charter there were some grievous articles, which the clemency of later princes has since by statute thought fit to alter *per assisas forestæ*. And to this day, in trespasses relating to the forest, *voluntas reputabitur pro facto*; so that if a man be taken hunting a deer, he may be arrested as if he had taken a deer.

Forest Towns, in *Geography*, certain towns of Suabia in Germany, lying along the Rhine, and the confines of Switzerland, and subject to the house of Austria. Their names are *Rhinefield*, *Seckingen*, *Laufenburg*, and *Waldshut*.

FORE-STAFF, an instrument used at sea for taking the altitudes of heavenly bodies. The fore-staff, called also *cross-staff*, takes its denomination hence, that the observer, in using it, turns his face towards the object; in opposition to the back-staff, where he turns his back to the object.

The fore or cross-staff, consists of a straight square staff, graduated like a line of tangents, and four crosses or vanes, which slide on it. The first and shortest of these vanes, is called the *ten cross*, or *vane*, and belongs to that side of the instrument on which the divisions begin at three degrees and end at ten. The next longer vane, is called the *thirty cross*, belonging to that side of the staff in which the divisions begin at ten degrees and end at thirty, called the *thirty scale*. The next vane is called the *sixty cross*, and belongs to the side where the divisions begin at twenty degrees and end at sixty. The last and longest, called the *ninety cross*, belongs to the side where the divisions begin at thirty degrees and end at ninety.

The use of this instrument is to take the height of the sun and stars, or the distance of two stars: and the ten, thirty, sixty, or ninety crosses, are to be used according as the altitude is greater or less; that is, if the altitude be less than ten degrees, the ten cross is to be used; if above ten, but less than thirty, the thirty cross is to be used, &c. *Note*, For altitudes greater than thirty degrees, this instrument is not so convenient as a quadrant or semicircle.

To observe an Altitude by this instrument.—Apply the flat end of the staff to your eye, and look at the upper end of the cross for the centre of the sun or star, and at the lower end for the horizon. If you see the sky instead of the horizon, slide the cross a little nearer the eye; and if you see the sea instead of the horizon, slide the cross farther from the eye; and thus continue moving till you see exactly the sun or star's centre by the top of the cross, and the horizon by the bottom thereof. Then the degrees and minutes, cut by the inner edge of the cross upon the side of the staff peculiar to the cross you use, give the altitude of the sun or star.

If it be the meridian altitude you want, continue your observation as long as you find the altitude increase, still moving the cross nearer to the eye. By substracting the meridian altitude thus found from 90 degrees, you will have the zenith distance. To work accurately, an allowance must be made for the height of the eye above the surface of the sea, viz. for one English foot, 1 minute; for 5 feet, $2\frac{1}{4}$; for 10 feet $3\frac{1}{2}$; for 20 feet, 5; for 40 feet, 7, &c. These minutes subtracted from the altitude observed, and added to the zenith distance observed, give the true altitude and zenith distance.

To observe the distance of two stars, or the moon's distance from a star, by the fore-staff.—Apply the instrument to the eye, and looking to both ends of the cross, move it nearer or farther from the eye till you see the two stars, the one on the one end, and the other on the other end of the cross; then the degrees and minutes cut by the cross on the side proper to the vane in use give the stars distance.

FORESTALLER, a person who is guilty of forestalling. See the next article.

FORESTALLING, in *Law*, buying or bargaining for any corn, cattle, victuals, or merchandise, in the way as they come to fairs or markets to be sold, before they get thither, with an intent to sell the same again at a higher price.

The punishment for this offence, upon conviction at the quarter sessions by two or more witnesses, is, for the first time, two months imprisonment and the loss of the goods, or the value; for the second offence the offender shall be imprisoned six months, and lose double the value of the goods: for the third offence he shall suffer imprisonment during the king's pleasure, forfeit all his goods and chattels, and stand on the pillory: but the statute does not extend to maltsters buying barley, or to badgers licensed.

FORESTER, a sworn officer of the forest, appointed by the king's letters patent, to walk the forest at all hours, and watch over the vert and venison; also to make attachments and true presentments of all trespasses committed within the forest.

If a man comes into a forest in the night, a forester cannot lawfully beat him before he makes some resistance; but in case such a person resists the forester, he may justify a battery. And a forester shall not be questioned for killing a trespasser that, after the peace cried to him, will not surrender himself, if it be not done on any former malice; though, where trespassers in a forest, &c. do kill a person that opposes them, it is murder in all, because they were engaged in an unlawful act, and therefore malice is implied to the person killed.

FORETHOUGHT FELONY, in *Scots Law*, signifies premeditated murder. See MURDER.

FORFAR, a town of Scotland, and capital of the county of that name, situated in N. Lat. 56. 37. W. Long. 2. 55. This town, with Dundee, Cupar, Perth, and St Andrew's, jointly send one member to the British parliament. It stands in the great valley of Strathmore that runs from Perth north-east to the sea, almost in a straight line, about 50 miles long and betwixt four and five miles broad, bounded on the south side by gentle hills, and on the north by the Grampian mountains.

Forfar is a very ancient town, and was once a royal residence. Here Malcolm Canmore held his first parliament in 1057. The ruins of his palace are still to be seen on the top of an artificial mount of a circular form, resting upon a base of about three acres of ground, and rising 50 feet high above the plain. The lake of Forfar, stretching two miles in length from east to west, and half a mile in breadth, and covering the palace on the north, afforded not only a plentiful supply of water for every purpose, but also added to the strength of the place. This lake, which abounds with trout, pike, perch, and eel, has been greatly reduced by draining; and fine marl has been found in strata from two to six and eight feet deep, with moss below ten feet deep.

Within this lake were formerly two islands raised by art, with buildings on each; to which Margaret, Malcolm Canmore's queen, retired after the decease of her husband. Part of the ruins of these edifices are still to be seen.

Little is known of Forfar till the middle of the 17th century, except an act passed in the 13th parliament of James VI. 21st July, 1593, in the following words, which affords a specimen of the manners and language of the times: "Our soveraine Lorde, understanding that be acte and ordinance maid anent observation of the Sabbath daie within this realme, the mercatte-daie of the burgh of Forfare, being the head burgh of the schire, quhilk was Sundaie, is taken from them; and his hienesse not willing that they in onie waies suld be prejudged hereby, therefore his hienesse, with advise of the estaites of this present parliament, alteris and changis their said mercatte-daie from Sundaie to Fridaie, and willis the samen Fridaie oukly to be their mercatte-daie to them in all times hereafter; and the samin to stande with the like priveleges and freedomes as the Sundaie did of before." The market day has been long held on Saturday.

During the usurpation of Oliver Cromwell, a detachment of his forces, after sacking Dundee, came to Forfar and burnt all the public records of the place; and the only charter the town now has is one granted by Charles II. after his restoration, confirming all its ancient rights and privileges.

As an evidence of the ignorance and barbarity of the times, it appears from the records of the trials kept in the charter-chest of Forfar, that nine persons were condemned and burnt here for witchcraft betwixt the years 1650 and 1662. These innocent people were all tried by a special commission from the lords of the privy council at Edinburgh; and although the commission expressly discharged torturing them on purpose to extort a confession of their guilt, yet, as it was then thought meritorious to obtain confession of guilt by whatever means, many inhuman cruelties were exercised upon the unfortunate objects; particularly, an iron boot was drawn upon one of their legs, and a wedge driven with great force between it and the leg. Another instrument, still carefully preserved here, was likewise used, and is called the *witch bridle*. It is made of iron in the shape of a dog's collar, with two pikes on the inside, about four inches distant and two and a half long. These pikes were put into the mouth, and the collar afterwards buckled strait on the back of the head, to which was affixed an iron chain, whereby the condemned persons were led to the place of execution called the *Play field*, about a quarter of a mile to the northward of the town.

The streets of Forfar are rather irregular; but many of the houses are neat and well built. Osnaburgs and coarse linens are manufactured here; and many of the inhabitants are employed in making a coarse kind of shoes. Population 5652 in 1811.

Forfar-Shire, a county of Scotland, of which Forfar is the capital. Including Angus, Glenisla, Glenesk, and Glenprossin, it extends between 40 and 50 miles from east to west, and 16 where broadest, though in some places the breadth does not exceed five miles. On the north it is divided from the Brae of Mar by a ridge of the Binchinnan mountains; it is bounded on the south by the frith of Tay and the British ocean, on the east by Mearns, and on the west by Perthshire. Part of the Grampian mountains runs through this county, which is agreeably diversified with hill and dale. It produces some lead and iron, together with freestone, slate, and limestone. Coarse linens and sail cloth are the chief manufactures of the county. It is well watered with lakes, rivers, rivulets, and fountains, shaded with large forests, roughened with brown mountains, and waved with green hills interspersed with fields and meadows, and adorned with fine seats and plantations. Their heaths and woods abound with hart, hind, roebuck, and moor game; their streams are stocked with trout and salmon. Their hills are covered with flocks of sheep, and their fields afford plentiful harvests of wheat and all sorts of grain. The mountains to the west and north are inhabited by Highlanders: but the Lowlanders possess the towns and champaign country, and are remarkable for their politeness and hospitality.

The population of this county in 1811 amounted to 107,264. But in the following table is exhibited a view of its population, at two different periods.

	Parishes.	Population in 1755.	Population in 1790—1798.
1	Aberbrothwick	2098	4676
	Aberlemno	943	1033
	Airly	1013	865
	Arbirlot	865	1055
5	Auchterhouse	600	600
	Barry	689	796
	Brechin	3181	5000
	Carmylie	745	700
	Carraldstone	269	260
10	Cortachy	1233	1020
	Craig	935	1314
	Dun	657	500
	Dundee	12,477	23,500
	Dunnichen	653	872
15	Edzell	862	963
	Essie and Nevay	500	630
	Fearn	500	490
	Fernell	799	620
	Forfar	2450	4756
20	Glammis	1780	2040

Glenisla

Forfarshire, Forfeiture.

	Parishes.	Population in 1755.	Population in 1790—1798.
	Glenisla	1852	1018
	Guthrie	584	571
	Innerarity	996	929
	Inverkeilor	1286	1747
25	Kettins	1475	1100
	Kingoldrum	780	600
	Kinnell	761	830
	Kinnettles	616	621
	Kirkden	585	727
30	Kirrymuir	3409	4358
	Lentrathen	1165	900
	Lethnot	635	505
	Liff	1311	1790
	Lochlee	686	608
35	Logie Pert	696	999
	Lunan	208	291
	Mains	709	876
	Maryton	633	529
	Menmuir	743	900
40	Moneikie	1345	1278
	Monifeith	1421	1218
	Montrose	4150	6194
	Muirhouse	623	462
	Newtyle	913	594
45	Oathlaw	435	430
	Panbride	1259	1460
	Rescobie	798	934
	Ruthven	280	220
	St Vigeans	1592	3336
50	Strathmartine	368	340
	Strickathro	529	672
	Tannadyce	1470	1470
53	Tealing	755	802
		68,297	91,001
	In 1801,		97,778
	In 1811,		107,264

See Forfarshire, Supplement.

FORFEITURE, originally signifies a transgression or offence against some penal law. The word is formed of the base Latin *forisfactura;* whence *forfaitura* and *forfaictura*, and the French *forfait*. *Forisfactura* comes of *forisfacere;* which, according to Isidore, signifies to "hurt or offend," *facere contra rationem;* and which is not improbably derived of *foris*, "out," and *facere*, "to do," q. d. an action out of rule or contrary to the rules. Borel will have *forfait* derived from the using of force or violence: Lobineau, in his glossary, will have *forisfacta* properly to signify a mulct or amend, not a *forfeit;* which latter he derives from the Bas-Breton *forfed*, "a penalty."

But, with us, it is now more frequently used for the effect of such transgression; or the losing some right, privilege, estate, honour, office, or effects, in consequence thereof; than for the transgression itself.

Forfeiture differs from *confiscation*, in that the former is more general; while confiscation is particularly applied to such things as become forfeited to the king's exchequer; and goods confiscated are said to be such as nobody claims.

Forfeitures may be either in *civil* or *criminal* cases.

I. With respect to the first, a man that hath an

2

Forfeiture.

estate for life or years, may forfeit it many ways, as well as by reason of felony; such as alienation, claiming a greater estate than he hath, or affirming the reversion to be in a stranger, &c. When a tenant in tail makes leases not warranted by the statute; a copyholder commits waste, refuses to pay his rent, or do suit of court; and where an estate is granted upon condition, or non-performance thereof, &c. they will make a forfeiture.

Entry for a forfeiture ought to be by him who is next in reversion, or remainder, after the estate forfeited. As if a tenant for life or years commits a forfeiture, he who has the immediate reversion or remainder ought to enter, though he has the fee, or only an estate-tail.

II. Forfeiture in criminal cases is twofold; of real, and personal estates.

1. As to real estates by Attainder in high treason, a man forfeits to the king all his lands and tenements of inheritance, whether fee-simple or fee-tail; and all his rights of entry on lands and tenements, which he had at the time of the offence committed, or at any time afterwards, to be for ever vested in the crown; and also the profits of all lands and tenements, which he had in his own right for life or years, so long as such interest shall subsist. This forfeiture relates backwards to the time of the treason committed; so as to avoid all intermediate sales and encumbrances, but not those before the fact: and therefore a wife's jointure is not forfeitable for the treason of her husband; because settled upon her previous to the treason committed. But her dower is forfeited, by the express provision of statute 5 and 6 Edw. VI. c. 11. And yet the husband shall be tenant by courtesy of the wife's lands, if the wife be attainted of treason; for that is not prohibited by the statute. But, though after attainder the forfeiture relates back to the time of the treason committed, yet it does not take effect unless an attainder be had, of which it is one of the fruits; and therefore, if a traitor dies before judgment pronounced, or is killed in open rebellion, or is hanged by martial law, it works no forfeiture of his lands: for he never was attainted of treason. But if the chief justice of the king's bench (the supreme coroner of all England) in person upon the view of the body of him killed in open rebellion, records it and returns the record into his own court, both lands and goods shall be forfeited.

Blackst. Comment.

The natural justice of the forfeiture or confiscation of property, for treason, is founded on this consideration: That he who hath thus violated the fundamental principles of government, and broken his part of the original contract between king and people, hath abandoned his connexions with society, and hath no longer any right to those advantages which before belonged to him purely as a member of the community; among which *social* advantages, the right of transferring or transmitting property to others is one of the chief. Such forfeitures, moreover, whereby his posterity must suffer as well as himself, will help to restrain a man, not only by the sense of his duty, and dread of personal punishment, but also by his passions and natural affections; and will interest every dependent and relation he has to keep him from offending: according to that beautiful sentiment of Cicero, "*nec vero me fugit quam sit acerbum, parentum scelera filiorum pœnis lui; sed hoc*

præclare

Forfeiture. *præclare legibus comparatum est, ut caritas liberorum amiciores parentes reipublicæ redderet.*" And therefore Aulus Cascellius, a Roman lawyer in the time of the triumvirate, used to boast that he had two reasons for despising the power of the tyrants, his old age and his want of children; for children are pledges to the prince of the father's obedience. Yet many nations have thought, that this posthumous punishment savours of hardship to the innocent; especially for crimes that do not strike at the very root and foundation of society, as treason against the government expressly does. And therefore, though confiscations were very frequent in the times of the earlier emperors, yet Arcadius and Honorius, in every other instance but that of treason, thought it more just, *ibi esse pœnam, ubi et noxa est;* and ordered, that "*peccata suos teneant auctores, nec ulterius progrediatur metus, quam reperiatur delictum;*" and Justinian also made a law to restrain the punishment of relations; which directs the forfeiture to go, except in the case of *crimen majestatis*, to the next of kin to the delinquent. On the other hand, the Macedonian laws extended even the capital punishment of treason, not only to the children, but to all the relations of the delinquent; and of course their estates must be also forfeited, as no man was left to inherit them. And in Germany, by the famous golden bull (copied almost *verbatim* from Justinian's code), the lives of the sons of such as conspire to kill an elector are spared, as it is expressed, by the emperor's *particular bounty*. But they are deprived of all their effects and rights of succession, and are rendered incapable of any honour ecclesiastical and civil: to the end, that being always poor and necessitous, they may for ever be accompanied by the infamy of their father; may languish in continual indigence; and may find (says this merciless edict) their punishment in living, and their relief in dying."

In England, forfeiture of lands and tenements to the crown for treason is by no means derived from the feodal policy, but was antecedent to the establishment of that system in this island; being transmitted from our Saxon ancestors, and forming a part of the ancient Scandinavian constitution. But in certain treasons relating to the coin (which seem rather a species of the *crimen falsi* than the *crimen læsæ majestatis*), it is provided by some of the modern statutes which constitute the offence, that it shall work no forfeiture of lands, save only for the life of the offenders; and by all, that it shall not deprive the wife of her dower. And, in order to abolish such hereditary punishment entirely, it was enacted by statute 7 Ann. c. 21. that, after the decease of the late pretender, no attainder for treason shall extend to the disinheriting of any heir, nor to the prejudice of any person, other than the traitor himself. By which the law of forfeitures for high treason would by this time have been at an end, had not a subsequent statute intervened to give them a longer duration. The history of this matter is somewhat singular, and worthy of observation. At the time of the union, the crime of treason in Scotland was, by the Scots law, in many respects different from that of treason in England; and particularly in its consequence of forfeitures of entailed estates, which was more peculiarly English; yet it seemed necessary, that a crime so nearly affecting government should, both in its essence and consequences, be put upon the same footing in both parts of the united kingdoms. In new modelling these laws, the Scots nation and the English house of commons struggled hard, partly to maintain, and partly to acquire, a total immunity from forfeiture and corruption of blood; which the house of lords as firmly resisted. At length a compromise was agreed to, which is established by this statute, viz. that the same crimes, and no other, should be treason in Scotland that are so in England; and that the English forfeitures and corruption of blood should take place in Scotland till the death of the then pretender, and then cease throughout the whole of Great Britain: the lords artfully proposing this temporary clause, in hopes (it is said) that the prudence of succeeding parliaments would make it perpetual. This has partly been done by the statute 17 Geo. II. c. 39. made in the year preceding the late rebellion, the operation of these indemnifying clauses being thereby still farther suspended till the death of the sons of the pretender.

In petit treason and felony, the offender also forfeits all his chattel interests absolutely, and the profits of all freehold estates during life; and after his death all his lands and tenements in fee simple (but not those in tail) to the crown, for a very short period of time: for the king shall have them for a year and a day, and may commit therein what waste he pleases; which is called the king's *year*, *day*, and *waste*. Formerly the king had only a liberty of committing waste on the lands of felons, by pulling down their houses, extirpating their gardens, ploughing their meadows, and cutting down their woods. And a punishment of a similar spirit appears to have obtained in the oriental countries, from the decrees of Nebuchadnezzar and Cyrus in the books of Daniel and Ezra; which, besides the pain of death inflicted on the delinquents there specified, ordain, "that their houses shall be made a dunghill." But this tending greatly to the prejudice of the public, it was agreed in the reign of Henry I. of England, that the king should have the profits of the land for one year and a day in lieu of the destruction he was otherwise at liberty to commit: and therefore *magna charta* provides, that the king shall only hold such lands for a year and a day, and then restore them to the lord of the fee, without any mention made of waste. But the statute 17 Edward II. *de prerogativa regis*, seems to suppose, that the king shall have his year, day, *and* waste; and not the year and day *instead* of waste: which Sir Edward Coke (and the author of the Mirror before him) very justly look upon as an encroachment, though a very ancient one, of the royal prerogative. This year, day, and waste, are now usually compounded for; but otherwise they regularly belong to the crown: and after their expiration the land would naturally have descended to the heir (as in gavelkind tenure it still does) did not its feudal quality intercept such descent, and give it by way of escheat to the lord. These forfeitures for felony do also arise only upon attainder; and therefore a *felo de se* forfeits no lands of inheritance or freehold, for he never is attainted as a felon. They likewise relate back to the time the offence was committed as well as forfeitures for treason, so as to avoid all intermediate charges and conveyances. This may be hard upon such as have unwarily engaged with the offender; but the cruelty and reproach must lie on the part, not of the law, but of of the criminal: who has thus knowingly and dishonestly involved others in his own calamities.

2. The forfeiture of goods and chattels accrues in every one of the high kinds of offence; in high treason, or misprision thereof, petit treason, felonies of all sorts whether clergyable or not, self murder or felony *de se*, petty larceny, standing mute, &c. For flight, also, on an accusation of treason, felony, or even petit larceny, whether the party be found guilty or acquitted, if the jury find the flight, the party shall forfeit his goods and chattels: for the very flight is an offence, carrying with it a strong presumption of guilt, and is at least an endeavour to elude and to stifle the course of justice prescribed by the law. But the jury very seldom find the flight: forfeiture being looked upon, since the vast increase of personal property of late years, as too large a penalty for an offence to which a man is prompted by the natural love of liberty.

There is a remarkable difference between the forfeiture of lands and of goods and chattels. (1.) Lands are forfeited upon *attainder*, and not before; goods and chattels are forfeited by *conviction*. Because in many of the cases where goods are forfeited, there is never any attainder; which happens only where judgment of death or outlawry is given: therefore, in those cases, the forfeiture must be upon conviction or not at all; and, being necessarily upon conviction in those, it is so ordered in all other cases, for the law loves uniformity. (2.) The forfeiture of lands has relation to the time the fact was committed, so as to avoid all subsequent sales and encumbrances: but the forfeiture of goods and chattels has no relation backwards; so that those only which a man has at the time of conviction shall be forfeited. Therefore a traitor or felon may *bona fide* sell any of his chattels, real or personal, for the sustenance of himself and family between the fact and conviction; for personal property is of so fluctuating a nature, that it passes through many hands in a short time; and no buyer could be safe, if he were liable to return the goods which he had fairly bought, provided any of the prior venders had committed a treason or felony. Yet if they be collusively and not *bona fide* parted with, merely to defraud the crown, the law (and particularly the statute 13 Eliz. c. 5.) will reach them; for they are all the while truly and substantially the goods of the offender: and as he, if acquitted, might recover them himself, as not parted with for a good consideration; so, in case he happens to be convicted, the law will recover them for the king.

FORFEX, in Roman antiquity, was a way of drawing up an army in the form of a pair of sheers. It was intended to receive the *cuneus* or wedge, if the enemy should make use of that figure. For when the forfex opened to admit the wedge, they had an opportunity of defeating their design, and cutting them in pieces.

FORFICULA, the EARWIG, a genus of insects belonging to the order of coleoptera. See ENTOMOLOGY *Index*.

FORGE, properly signifies a little furnace, wherein smiths and other artificers of iron or steel, &c. heat their metals red hot, in order to soften them and render them more malleable and manageable on the anvil.

An ordinary forge is nothing but a pair of bellows, the nozzle of which is directed upon a smooth area,

on which coals are placed. The nozzle of a pair of bellows may be also directed to the bottom of any furnace, to excite the combustion of the coals placed there, by which a kind of forge is formed. In laboratories, there is generally a small furnace consisting of one cylindrical piece, open at top, which has at its lower side a hole for receiving the nozzle of a double bellows. This kind of forge furnace is very convenient for fusions, as the operation is quickly performed, and with few coals. In its lower part, two inches above the hole for receiving the nozzle of the bellows, may be placed an iron plate of the same diameter, supported upon two horizontal bars, and pierced near its circumference with four holes diametrically opposite to each other. By this disposition, the wind of the bellows, pushed forcibly under this plate, enters at these four holes; and thus the heat of the fire is equally distributed, and the crucible in the furnace is equally surrounded by it. This contrivance is used in the forge-furnaces for melting copper, with this difference only, that these furnaces are square, which is a matter of no consequence.

As the wind of bellows strongly and rapidly excites the action of the fire, a forge is very convenient when a great heat is to be applied quickly: but it is not suitable when the heat is to be gradually increased.

The forge, or blast of bellows, is used in several operations in small; as to fuse salts, metals, ores, &c. It is also much used in works in the great, which require strong heat, without much management; and chiefly in the smelting of ores, and fusion of metallic matters.

FORGE is also used for a large furnace, wherein iron ore, taken out of the mine, is melted down: or it is more properly applied to another kind of furnace, wherein the iron-ore, melted down and separated in a former furnace, and then cast into sows and pigs, is heated and fused over again, and beaten afterwards with large hammers, and thus rendered more soft, pure, ductile, and fit for use.

FORGE, in the train of artillery, is generally called a *travelling forge*, and may not be improperly called a portable smith's shop: at this forge all manner of smith's work is made, and it can be used upon a march as well as in camp. Formerly they were very ill contrived, with two wheels only, and wooden supporters to prop the forge for working when in the park. Of late years they are made with four wheels, which answers the purpose much better.

FORGE for red-hot Balls, is a place where the balls are made red hot before they are fired off: it is built about five or six feet below the surface of the ground, of strong brick-work, and an iron grate, upon which the balls are laid, with a large fire under them.

FORGER, in *Law*, one guilty of FORGERY.

FORGERY, (from the French *forger*, i. e. *accudare, fabricare*, " to beat on an anvil, forge, or form,") may be defined at common law, to be " the fraudulent making or alteration of a writing, to the prejudice of another man's right:" for which the offender may suffer fine, imprisonment, and pillory. And also, by a variety of statutes, a more severe punishment is inflicted on the offender in many particular cases, which are so multiplied of late as almost to become general. We shall mention the principal instance.

By statute 5 Eliz. c. 14. to forge or make, or knowingly

ingly to publish or give in evidence, any forged deed, court-roll, or will, with intent to affect the right of real property, either freehold or copyhold, is punished by a forfeiture to the party grieved of double costs and damages; by standing in the pillory, and having both his ears cut off, and his nostrils slit and seared; by forfeiture to the crown of the profits of his lands, and by perpetual imprisonment. For any forgery relating to a term of years or annuity, bond, obligation, acquittance, release, or discharge of any debt or demand of any personal chattels, the same forfeiture is given to the party grieved; and on the offender is inflicted the pillory, loss of one of his ears, and half a year's imprisonment: the second offence, in both cases, being felony without benefit of clergy.

Besides this general act, a multitude of others, since the Revolution (when paper credit was first established), have inflicted capital punishment on the forging, altering, or uttering as true when forged, of any bank bills or notes, or other securities; of bills of credit issued from the exchequer; of South Sea bonds, &c; of lottery tickets or orders: of army or navy debentures; of East India bonds; of writings under seal of the London or royal exchange assurance; of the hand of the receiver of the pre-sines, or of the accountant-general and certain other officers of the court of chancery; of a letter of attorney or other power to receive or transfer stock or annuities; and on the personating a proprietor thereof, to receive or transfer such annuities, stock or dividends: also on the personating, or procuring to be personated, any seaman or other person, entitled to wages or other naval emoluments, or any of his personal representatives; and the taking, or procuring to be taken, any false oath in order to obtain a probate or letters of administration, in order to receive such payments; and the forging or procuring to be forged, and likewise the uttering or publishing, as true, of any counterfeited seaman's will or power; to which may be added, though not strictly reducible to this head, the counterfeiting of Mediterranean passes under the hands of the lords of the admiralty, to protect one from the piratical states of Barbary; the forging or imitating of any stamps to defraud the public revenue; and the forging of any marriage register or license: all which are, by distinct acts of parliament, made felonies without benefit of clergy. By statutes 13 Geo. III. c. 52. and 59. forging or counterfeiting any stamp or mark to denote the standard of gold and silver plate, and certain other offences of the like tendency, are punished with transportation for 14 years. By statute 12 Geo. III. c. 48. certain frauds on the stamp-duties, therein described, principally by using the same stamps more than once, are made single felony, and liable to transportation for seven years. And the same punishment is inflicted by statute 13 Geo. III. c. 38. on such as counterfeit the common seal of the corporation for manufacturing plate glass (thereby erected), or knowingly demand money of the company by virtue of any writing under such counterfeit seal.

There are also two other general laws with regaid to forgery; the one 2 Geo. II. c. 25. whereby the first offence in forging or procuring to be forged, acting or assisting therein, or uttering or publishing as true, any forged deed, will, bond, writing obligatory, bill of exchange, promissory note, indorsement or assignment thereof, or any acquittance or receipt for money or goods, with intention to defraud any person (or corporation), is made felony without benefit of clergy. And by statute 7 Geo. II. c. 22. it is equally penal to forge, or cause to be forged, or utter as true, a counterfeit acceptance of a bill of exchange, or the number of any accountable receipt for any note, bill, or any other security for money, or any warrant or order for the payment of money or delivery of goods. So that, through the number of these general and special provisions, there is now hardly a case possible to be conceived, wherein forgery, that tends to defraud, whether in the name of a real or fictitious person, is not made a capital crime.

FORGING, in *Law*, the act of FORGERY.

FORGING, in smithery, the heating or hammering iron on an anvil, after having first made it red hot in the forge, in order to extend it into various forms, and fashion it into various works.

There are two ways of forging and hammering iron. One is by the force of the hand, in which there are usually several persons employed, one of them turning the iron and hammering likewise, and the rest only hammering. The other way is by the force of a water-mill, which raises and works several huge hammers beyond the force of man; under the strokes whereof the workmen present large lumps or pieces of iron, which are sustained at one end by the anvils, and at the other by iron chains fastened to the ceiling of the forge. See MILL.

This last way of forging is only used in the largest works, as anchors for ships, &c. which usually weigh several thousand pounds. For the lighter works, a single man serves to hold, heat, and turn with one hand, while he hammers with the other.

Each purpose the work is designed for requires its proper heat; for if it be too cold, it will not feel the weight of the hammer, as the smiths call it when it will not batter under the hammer; and if it be too hot, it will red sear, that is, break or crack under the hammer.

The several degrees of heat the smiths give their iron, are, first, a blood-red heat; secondly, a white-flame heat; and thirdly, a sparkling or welding heat.

FORISFAMILIATION, in *Law*, When a child, upon receiving a portion from his father, or otherwise, renounces his legal title to any further share of his father's succession, he is said to be *forisfamiliated*.

FORK, a well known instrument, consisting of a handle and blade, divided at the end into two or more points or prongs.

The *pitch-fork* is a large utensil of this construction employed in hay-making, &c.

The *table-fork*, an instrument now so indispensable, did not come into use in England till the reign of James I. as we learn from a remarkable passage in Coryat. The reader will probably smile at the solemn manner in which this important discovery or innovation is related: "Here I will mention a thing that might have been spoken of before in discourse of the first Italian townes. I observed a custom in all those Italian cities and townes through the which I passed, that is not used in any other country that I saw in my travels, neither do I thinke that any other nation of Christen-

dome

Fork || Form.

dome doth use it, but only Italy. The Italians and also most strangers that are commorant in Italy, doe always at their meals use a little forke when they eat their meate; for while with their knife which they hold in one hand they cut the meate out of the dish, they fasten the forke which they hold in the other hand upon the same dish, so that whatsoever he be that sitting in the company of any others at meale shall unadvisedly touch the dish of meat with his fingers from which all the table doe cut, he will give occasion of offence unto the company as having transgressed the lawes of good manners, insomuch that for his error he shall be at least brow-beaten if not reprehended in wordes. This form of feeding I understand is generally used in all parts of Italy, their forkes for the most part being made of yronn, steele, and some of silver, but those are used only by gentlemen. The reason of this their curiosity is, because the Italian cannot by any means indure to have his dish touched with fingers, seeing all men's fingers are not alike cleane. Hereupon I myself thought good to imitate the Italian fashion by this forked cutting of meate, not only while I was in Italy, but also in Germany, and often times in England since I came home: being once qnipped for that frequently using my forke, by a certain learned gentleman, a familiar friend of mine, Mr Lawrence Whitaker; who in his merry humour doubted not to call me a table *furcifer*, only for using a forke at feeding, but for no other cause."

FORLI, an ancient and considerable town of Italy, and capital of a territory of the same name, in Romagna, with a bishop's see. The public structures are very handsome; and it is seated in a fertile, healthy, and pleasant country, 10 miles south-east of Faenza, and 45 north-east of Florence. E. Long. 12. 1. N. Lat. 44. 28.

FORLORN-HOPE, in the military art, signifies men detached from several regiments, or otherwise appointed, to make the first attack in day of battle; or at a siege, to storm the counterscarp, mount the breach, or the like. They are so called from the great danger they are unavoidably exposed to; but the word is old, and begins to be obsolete.

FORM, in *Physics*, denotes the manner of being peculiar to each body; or that which constitutes it such a particular body, and distinguishes it from every other.

Mr Harris uses the term *form* likewise in another sense, as an efficient animating principle; to which he supposes Ovid to refer in the first lines of his Metamorphoses.

> *In nova fert animus mutatas dicere* formas,
> *Corpora.*———

These animating forms are of themselves no objects either of the ear or of the eye; but their nature or character is understood in this, that were they never to exert their proper energies on their proper subjects, the marble on which the sculptor exercises his art would remain for ever shapeless, and the harp from which the harper calls forth sounds would remain for ever silent.

Thus also, the animating form of a natural body is neither its organization nor its figure, nor any other of those inferior forms which make up the system of its visible qualities: but it is the power, which is yet able to produce, preserve, and employ these. It is the power, which first moves, and then conducts that latent process, by which the acorn becomes an oak, and the embryo becomes a man; by which digestion is performed in plants and animals, and, which departing, the body ceases to live, and its members putrefy: and by which every being produces another like itself, and every species is continued. In animals, it is that higher faculty, which, by employing the organs of sense, peculiar to them as animals, distinguishes them as sensitive beings from vegetables; and it is also that more noble faculty, which by its own divine vigour, unassisted perhaps with organs, makes and denominates him a being intellective and rational. So that Mr Harris reckons two sorts of forms, those which are passive elements, and those which are efficient causes. And all of them agree in this, that they give to every being its peculiar and distinctive character: and on the whole he concludes, that form appears in part to be an element, and in part an efficient cause, i. e. a cause which associates the constituent elements of natural substances, and which employs them, when associated, according to their various and peculiar characters.

Form.

The philosophers generally allow two principles of bodies: *matter*, as the common basis or substratum of all; and *form*, as that which specifies and distinguishes each; and which added to a quantity of common matter, determines or denominates it this or that; wood, or fire, or ashes, &c.

Substantial forms seem to have been first broached by the followers of Aristotle, who thought matter, under different modes or modifications, not sufficient to constitute different bodies; but that something substantial was necessary to set them at a greater distance: and thus introduced substantial forms, on the footing of souls, which specify and distinguish animals. What led to this erroneous notion were the circumstances of life and death: For observing, that, as soon as the soul was departed out of a man, all motion, respiration, nutrition, &c. immediately ceased, they concluded, that all these functions depended on the soul, and consequently that the soul was the form of the animal body, or that which constituted it such: that the soul was a substance, independent of matter, nobody doubted; and hence the forms of other bodies were concluded equally substantial. But to this it is answered, that though the soul be that by which a man is man, and consequently is the form of the human body, as human; yet it does not follow, that it is properly the form of this body of ours, as it is a body; nor of the several parts thereof, considered as distinct from each other: For those several parts have their proper forms so closely connected with their matter, that it remains inseparable therefrom long after the soul has quitted the body; thus flesh has the form of flesh, bone of bone, &c. long after the soul is removed as well as before. The truth is, the body does not become incapable of performing its accustomed functions because the soul has deserted it; but the soul takes its leave, because the body is not in a condition to perform its functions.

The ancient and modern corpuscular philosophers, therefore, with the Cartesians, exclude the notion of substantial forms; and show, by many arguments, that

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the form is only the modus or manner of the body it is inherent in. And as there are only three primary modes of matter, viz. figure, rest, or motion, with two others arising therefrom, viz. magnitude and situation, the form of all bodies they hold to consist therein; and suppose the variations these modes are capable of, sufficient to present all the variety observable in bodies.

Forms are usually distinguished into *essential* and *accidental*.

Essential. Though the five modes above mentioned, generally taken, be adventitious; yet to this or that body, *e. gr.* to fire or water, they are essential: thus it is *accidental* to iron, to have this or that magnitude, figure, or situation, since it might exist in different ones; yet to a knife or hammer, the figure, magnitude, and position of parts, which constitute it a hammer or knife, are essential; and they cannot exist or be conceived without them. Hence it is inferred, that though there be no substantial, there are essential forms, whereby the several species of bodies become what they are, and are distinguished from all others.

Accidental forms, are those really inherent in bodies, but in such manner as that the body may exist in all its perfection without them. Such as whiteness in a wall, heat in water, a figure of a man in wax, &c.

Form is also used, in a moral sense, for the manner of being or doing a thing according to rules: thus we say, a form of government, a form of argument, &c.

Form, in *Law*, the rules established and requisite to be observed in legal proceedings. The formal part of the law, or method of proceeding, cannot be altered but by parliament; for if once these outworks were demolished, there would be an inlet to all manner of innovation in the body of the law itself.

Form, in carpentry, is used to denote the long seats or benches in the choirs of churches or in schools, for the priests, prebends, religious, or scholars, to sit on. Du Cange takes the name to be derived from hence, that the backs of the seats were anciently enriched with figures of painting and sculpture, called in Latin *formæ et typi*. In the life of St William of Roschild, we meet with *forma* as signifying a seat for an ecclesiastic, or religious, in a choir; and in that of St Lupicin, we have formula in the same sense. In the rule of the monastery of St Cæsarea, the man who presides over the choir is called *primiceria, vel formari*.

At schools, the word *form* is frequently applied to what is otherwise termed a *class*. See Class.

Form also denotes the external appearance or surface of a body, or the disposition of its parts as to the length, breadth and thickness.

Form is also used among mechanics, for a sort of mould wherein any thing is fashioned or wrought.

Printer's Form, an assemblage of letters, words, and lines, ranged in order, and so disposed into pages by the compositor; from which, by means of ink and a press, the printed sheets are drawn.

Every form is enclosed in an iron chess, wherein it is firmly locked by a number of pieces of wood; some long and narrow, and others of the form of wedges. There are two forms required for every sheet, one for each side; and each form consists of more or fewer pages according to the size of the book.

Hatter's Form, is a large block or piece of wood, of a cylindrical figure; the top thereof rounded, and the bottom quite flat. Its use is, to mould or fashion the crown of the hat, after the matter thereof has been beaten and fulled.

Papermaker's Form, is the frame or mould wherein the sheets are fashioned. See Paper.

FORMA pauperis, in *Law*, is when a person has just cause of suit, but is so poor that he cannot defray the usual charges of suing at law or in equity; in which case, on making oath that he is not worth 5l. in the world, on all his debts being paid, and producing a certificate from some lawyer that he has good cause of suit, the judge will admit him to sue in *forma pauperis;* that is, without paying any fee to counsellors, attorneys, or clerk: the statute 11 Hen. VII. c. 12. having enacted, that counsel and attorneys, &c. shall be assigned to such poor persons *gratis*. Where it appears that any pauper has sold or contracted for the benefit of his suit whilst it is depending in court, such cause shall be thenceforth totally dismissed; and a person suing *in forma pauperis* shall not have a new trial granted him, but is to acquiesce in the judgment of the court.

FORMAL, something belonging to or constituting the form of a thing. See Form.

FORMALITY, the quality of a form, or formula; or that which constitutes and denominates them such.

Formality, as defined in the schools, is any manner wherein a thing is conceived; or a manner in any object, importing a relation for the understanding whereby it may be distinguished from another object. Thus animality and rationality are formalities. The Scottists made great use of formalities, in opposition to the virtualities of the Thomists.

Formalities, in matters of law, are frequently used for the formulas themselves, or the rules prescribed for judiciary proceedings. In contracts of strict law, all the formalities must be strictly observed: an omission of the least formality may ruin the whole convention.

The term is also used for a certain order or decorum to be observed.

FORMAN, Andrew, archbishop of St Andrew's, earl of Pittenweem, and of Cottingham in England, one of the lords of the regency appointed by the states during the minority of King James V. of Scotland, legate à latere, primate of all the kingdom of Scotland, and archbishop of Bourges in France, was descended from the family of the Formans of Hutton in the shire of Berwick, and is considered to have been one of the best statesmen of the age in which he lived. He was employed in 1501, along with Robert Blackader, archbishop of Glasgow, and Patrick earl of Bothwell to negotiate a match between Ja. IV. of Scotland and Margaret eldest daughter of Hen. VII. of England, which next year was ratified by the Scottish ambassadors. He was afterwards frequently employed as Scots ambassador to Rome, England, and France, upon the most important occasions. In 1514, he was translated from the see of Moray, to which he had been appointed in 1502, to that of St Andrews. During the time of his

his possessing the former, he was employed as mediator betwixt Pope Julius II. and Louis XII. of France, who were at that time at variance; and he happily succeeded in conciliating the difference. Having taken leave of the Pope, he passed through France on his return home, where he was kindly received by the king and queen, who bestowed upon him the bishopric of Bourges in France, which annually brought him in 400 tons of wine, 10,000 francs of gold, and other smaller articles. Besides all this, he was most liberally rewarded by Pope Julius, who promoted him to the archbishopric of St Andrew's, as has been already mentioned; conferred on him the two rich abbeys of Dunfermline and Aberbrothic; and made him his legate à latere. At that time, however, there were two other candidates for the archiepiscopal see. The learned Gavin Douglas, bishop of Dunkeld, having been nominated by the queen, had actually taken possession of it; but John Hepburn, a bold and factious man, having been preferred by the monks, drove out the officers of Gavin Douglas, and placed a strong garrison in the castle. So great was the power of this man, that when Forman was nominated by the Pope, no person could be found who durst proclaim the bulls for his election. At last Lord Home, at that time the most powerful nobleman in Scotland, was induced, by large promises, besides some gifts of great consequence, among which was the donation of the abbacy of Coldingham to his youngest brother David, to undertake the task. It was executed at Edinburgh and St Andrew's; to which places Lord Home's brother went with 10,000 men; though the doing of it, contrary to Forman's inclination, proved a source of much trouble to that nobleman afterwards. The quarrel betwixt Hepburn and Forman, however, was at last terminated by the latter surrendering the bishopric of Moray, as well as some years revenue of the archbishopric itself; paying Hepburn also 3000 French crowns annually out of his ecclesiastical revenues. On the appointment of the duke of Albany to the regency, Hepburn endeavoured to undermine the primate's credit with that nobleman, by representing him as one who had in a manner collected all the money in the country, and who consequently might endanger the tranquillity of the kingdom. These insinuations, however, were but little regarded by the regent; and Forman had the good fortune afterwards to make up a difference between him and the nobility, which was likely to be attended with much bloodshed. In 1517, the archbishop was appointed by the states one of the lords of the regency, on occasion of the duke of Albany's going to France. We have already mentioned his embassy to Pope Julius II. In M'Kenzie's Lives we are informed, that in the collection of the Letters of the Scottish Kings from the year 1505 till the year 1626, in the lawyers library, there is a letter from the pope to King James IV. wherein he not only highly commends Forman, but likewise promises that at the first creation of cardinals he should be made one. This letter is dated the 6th of May 1511: but the pope died before he had an opportunity of performing his promise. In the same collection there is a letter from the duke of Albany to Leo X. Julius's successor, wherein he presses the pope to advance him to the dignity of a cardinal promised him by his predecessor, and to continue him his legate à latere. Archbishop Forman died in 1521, and was buried at Dunfermline. Dempster says that he wrote a book against Luther, a book concerning the Stoic Philosophy, and a Collection out of the Decretals.

FORMATION, in *Philosophy*, an act whereby something is formed or produced. For the formation of the fœtus in the womb, see ANATOMY, N° 109, 110.

FORMATION of Stones. See STONE.

FORMATION of Metals and Minerals. See METAL and MINERAL.

FORMATION, in *Grammar*, signifies the manner of forming one word from another; thus *accountantship* is formed from *accountant*, and this last from *account*.

FORMEDON, in *Law*, (breve *de forma donationis*), a writ that lies for a person who has a right to lands or tenements, by virtue of any entail, arising from the statute of Westm. 2. Ch. II.

This writ is of three kinds, viz. a descender, remainder, and reverter. Formedon in *descender*, lies where a tenant in tail infeoffs a stranger, or is disseised and dies, and the heir may bring this writ to recover the lands. Formedon in *remainder*, lies where a man gives lands, &c. to a person in tail, and for the default of issue of his body, the remainder to another in tail: here if the tenant in tail die without issue, and a stranger abates and enters into the land, he in remainder shall have this writ. Formedon in *reverter*, lies where lands are entailed on certain persons and their issue, with remainder over for want of issue; and on that remainder failing, then to revert to the donor and his heirs: in this case, if the tenant in tail dies without issue, and also he in remainder, the donor and his heirs, to whom the reversion returns, may have this writ for the recovery of the estate, though the same be alienated, &c.

FORMIÆ, or FORMIA, in *Ancient Geography*, a maritime town of the Adjected or New Latium, to the south-east of Cajeta; built by the Lacedæmonians, (Strabo); called originally *Hormiæ*, on account of its commodious harbour. An ancient municipium. *Formiani*, the people; who were admitted to the liberty of the city the very year in which Alexandria was built; but not to the right of suffrage till a long time after the second Punic war, (Livy). *Formiæ* at this day lies in ruins, near a place now called *Mola*.

FORMICA, the ANT, a genus of insects belonging to the order of hymenoptera. See ENTOMOLOGY *Index*.

The insects called *white ants*, which abound in Africa and the East Indies, belong to the genus termes, which see in ENTOMOLOGY *Index*.

FORMICA Leo, the *Ant lion*, so called from its devouring great numbers of ants. It is the caterpillar or worm of a fly much resembling the libellæ or dragon flies; and feeds chiefly upon ants.

FORMING is used for the act of giving being or birth to any thing.

The word is also simply used for giving the figure to any thing. The potter forms his vessels as he pleases. Geometry teaches how to form all kinds of figures.

It is likewise used for the producing of a thing: thus, the lineaments of the face began to be formed.

Forming, Formosa.

Forming of a Siege, is the making lines of circumvallation to fortify the camp, and disposing things for the attack of a place in form.

They also say, to form a squadron or battalion; meaning to range the soldiers in form of a squadron, &c.

Forming the Line, is drawing up infantry, cavalry, and artillery, into line of battle. See Line.

Forming is also used in grammar, in speaking of certain tenses of verbs, which are made from others by a change of certain letters. The present tense is formed from the infinitive. Compound and derivative words also, and even all that have any etymology, are said to be formed.

FORMOSA, an island in the Pacific ocean, between 119° and 122° of E. Long. and 22° and 25° N. Lat. about 100 miles east of Canton in China. It is subject to the Chinese; who, however, notwithstanding its vicinity, did not know of its existence until the year 1430. It is about 85 leagues in length, and 25 in breadth. A long chain of mountains, which runs from north to south, divides it into two parts, the eastern and western. The Dutch formed an establishment in the western part in 1634, and built the fort of Zealand, which secured to them the principal port of the island; but they were driven from thence in 1659 or 1661 by a celebrated Chinese pirate, who made himself master of all the western part, which afterwards submitted in 1682 to the authority of Kang-he emperor of China.

This western part of Formosa is divided into three distinct governments, all subordinate to the governor of Tai-ouan, the capital of the island, who is himself subject to the viceroy of the province of Fokien.

This island presents extensive and fertile plains, watered by a great number of rivulets that fall from the eastern mountains. Its air is pure and wholesome; and the earth produces in abundance, corn, rice, and the greater part of other grains. Most of the Indian fruits are found here, such as oranges, bananas, pine-apples, guavas, papaws, cocoa nuts; and part of those of Europe, particularly peaches, apricots, figs, raisins, chesnuts, pomegranates, water melons, &c. Tobacco, sugar, pepper, camphire, and cinnamon, are also common. Horses, sheep, and goats, are very rare in this island: there are even few hogs, although these animals abound in China. Domestic poultry, such as fowls, geese, and ducks, are exceedingly plenty; pheasants also are sometimes seen; and monkeys and stags have multiplied so much, that they wander through the country in large flocks.

The inhabitants of Formosa rear a great number of oxen, which they use for riding, from a want of horses and mules. They accustom them early to this kind of service, and by daily exercise train them to go as well and as expeditiously as the best horses. These oxen were furnished with a bridle, saddle, and crupper. A Chinese looks as big and proud when mounted in this manner, as if he were carried by the finest Barbary courser.

Wholesome water fit for drinking is the only thing wanting in the island of Formosa. It is very extraordinary, that every kind of water in it is a deadly poison to strangers, for which no remedy has hitherto been found. "One of the governor's servants," says Father de Mailla, "whom I had in my train (a strong and robust man), trusting too much to the force of his constitution, would not believe what had been told him concerning this water: he drank some of it; and died in less than five days, after every medicine and antidote had been administered without success. There is none but the water of the capital which can be drunk: the mandarins of the place therefore always took care to transport a sufficiency of it in carts for our use." Our author adds, that at the bottom of a mountain a league distant from Fong-kan-hien there is a spring that produces a stream, the water of which is of a whitish blue colour, and so noxious, that no one can approach it.

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There are few mulberry trees in Formosa, consequently little silk is made in the country. Numerous manufactures, however, would soon be introduced into it, were the Chinese permitted indiscriminately to transport themselves thither, and to form establishments in the island. Those who go to it must be protected by passports from the Chinese mandarins, and these passports are sold at a dear rate; securities are besides required. This is not all: when they arrive, money must be given to the mandarins who are appointed to examine those who enter or quit the island, and who generally discharge this duty with the most rigid severity. If they give no present, or offer only a trifle, they meet with little mercy: and are sure to be sent back, whatever passport they may have. The Chinese, through policy, connive at these exactions, to prevent too great a number of people from emigrating to this island, which is rendered a place of great importance by its proximity to China. They fear, and with great reason (especially since Tartar emperors have been on the throne), that if any revolt should happen in Formosa, its influence might spread and occasion great disturbance in the whole empire. On this account, the Tartars keep a garrison there of 10,000 men: which they take care to change every three years, or even oftener if they judge it necessary.

Besides the capital, the Chinese have also two other cities, and some villages, where they inhabit alone; for they do not permit the Indians, who are their subjects, to live among them; they suffer none to remain but those who are either their slaves or domestics.—These Indians are united into 45 villages; 36 of which lie to the north, and 9 towards the south. The northern villages are very populous, and the houses are built almost after the Chinese manner. The habitations of the southern islanders are only heaps of huts or cottages of earth. In these huts they have neither chairs, benches, tables, beds, nor any piece of furniture; the middle part is occupied by a kind of hearth or chimney, raised two feet high, and constructed of earth, upon which they dress their victuals. Their ordinary food is rice, other small grain, and the game which they catch by coursing or kill with their arms. These islanders run with such surprising swiftnes, that they can almost outstrip the fleetest greyhound. The Chinese attribute this agility to the precaution they take of confining their knees and reins by a close bandage until the age of 14 or 15. Their favourite arms are lances, which they dart to the distance of 60 or 80 feet with the greatest dexterity and precision. They use bows and arrows, and can kill a pheasant on wing with

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as much certainty as an European sportsman could with a fusee. These people are very dirty in their manner of eating. They have neither plates, dishes, nor spoons, nor even the small sticks used in China. Whatever they dress is placed on a plain board or mat, and they make use of their fingers for conveying it to their mouths. They eat flesh half raw; and provided it has been only presented to the fire, it appears to them excellent. Their beds are formed of fresh gathered leaves. They go almost naked, and wear only a piece of cloth which hangs from their girdle to their knees. Those among them, who, according to the judgment of the chiefs of the village, have borne away the prize for agility in running, or dexterity in the chase, obtain the honourable privilege of making on their skin, by a very painful operation, several fantastical figures of flowers, trees, and animals. All have the right of blackening their teeth, and of wearing ornaments of bracelets and crowns made of shells and crystal.

The islanders who inhabit the northern part, where the climate is somewhat colder, clothe themselves with the skins of the stags which they kill in hunting. They make a kind of dress of them without sleeves, that pretty much resembles a dalmatic, or vestment worn at the altar by the Roman clergy. They wear on their heads caps in the form of a cylinder, made of palm leaves, and ornamented with several crowns placed one above another, on the top of which they fix plumes composed of the feathers of a cock or pheasant.

The marriage ceremonies of the inhabitants of Formosa approach near to the simple laws of nature. They neither purchase, as in China, the women whom they espouse, nor does interest ever preside over their unions. Fathers and mothers are scarcely ever consulted. If a young man has a mind to marry, and has fixed his affection on a young girl, he appears for several days following near the place where she lives with a musical instrument in his hand. If the young woman is satisfied with the figure of her gallant, she comes forth and joins him: they then agree and settle the marriage contract. After this, they give notice to their parents who prepare a wedding dinner, which is always given in the house where the young woman resides, and where the bridegroom remains without returning again to his father. The young man afterwards considers the house of his father-in-law as his own. He becomes the whole support of it, and he has no farther connection with that of his father; like married women in Europe, who generally quit their paternal home in order to live with their husbands. These islanders therefore seldom offer up vows for obtaining male children: they prefer daughters, because they procure them sons-in-law, who become their supports in old age.

Although the Formosans are entirely subjected to the Chinese, they still preserve some remains of their ancient government. Each village chooses three or four old men from among those who have the greatest reputation for probity. By this choice they become the rulers and judges of the rest of the hamlet. They have the power of finally determining all differences; and if any one should refuse to abide by their judgment, he would be immediately banished from the village, without hopes of ever being able to re-enter it, and none of the inhabitants would afterwards dare to receive him.

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The natives pay in grain the tribute imposed on them by the Chinese. To regulate every thing that concerns the laying on and collecting of this impost, government has established a Chinese in every village, who is obliged to learn the language and act as interpreter to the mandarins. These interpreters are most cruel extortioners to the miserable people, whom they ought rather to protect: they are such insatiable leeches that they can scarcely ever be satisfied. This daily and domestic tyranny has already caused the defection of three villages in the southern part of the island, where formerly there were twelve. The inhabitants of these villages revolted, expelled their interpreters, refused to pay tribute any longer to the Chinese, and have united themselves to the independent nation in the eastern part of the island.

It was in the island of Formosa that John Struys affirms to have seen with his own eyes a man who had a tail more than a foot in length, covered with red hair, and greatly resembling that of an ox. This man with a tail said, that his deformity, if it was one, proceeded from the climate, and that all those of the southern part of the island were born with tails like his.—But John Struys is the only author who attests the existence of this extraordinary race of men; no other writer who has spoken of Formosa makes the least mention of them. Another circumstance, no less singular, and which appears to be little better authenticated, is, that in this island women are not permitted to bring forth children before they are 35, although they are at liberty to marry long before that age. Rechteren * thus expresses himself concerning this strange custom.

"When women are first married, they bring no children into the world: they must, before that is permitted, have attained the age of 35 or 37. When they are big with child, their priestesses pay them a visit, and tread on their bellies with their feet, if it be necessary, and make them miscarry, with perhaps greater pains than they would have in being brought to bed. It would be not only a shame, but an enormous crime, to bring forth a child before the time prescribed. I have seen some females who had already destroyed the fruit of their womb 15 or 16 times, and who were big for the 17th when it was lawful for them to bring forth a living child."

* *Dutch East Ind. Company Voyages*, vol. v. p. 9.

To our description of Formosa we shall add the following account of a dreadful disaster that befel this unhappy island. The details were conveyed by a letter from Peking, addressed to M. Bertin, and dated the 14th of July 1782.

"The waters of the ocean have well nigh deprived China of one of its most valuable maritime possessions. The island of Tay-ouan, known in Europe by the name of Formosa, has been almost swallowed up by them. It has been reported here, that part of the mountain which divides the island has sunk and disappeared; that the rest has been overturned; and that the greater part of the inhabitants have perished. Such have been for some days the popular reports in this capital. Government, however, has put a stop to them, by informing the public of the real truth; such as it

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has been announced to the emperor by the officers who have this small portion of his territories under their jurisdiction. I cannot do better than transcribe what they have written. The dispatches of the Chinese officers, addressed to the emperor, run thus:

" Bechen, governor-general of the province of Fokien and Tche-Kyang-ya, viceroy of Fokien, and others, make known to your majesty the disaster that has lately befallen the island of Tay-ouan. Mon-ha-hon, and other principal officers of this island, have acquainted us, that on the 21st of the fourth moon (May 22. 1782), a most furious wind, accompanied with heavy rain and a swell of the sea greater than ever remembered, had kept them under continual apprehension of being swallowed up by the waves, or buried in the bowels of the earth, from the hour of *yn* until the hour *ouei* (A). This dreadful tempest seemed to blow at the same time from the four cardinal points of the compass, and continued with equal violence during the above-mentioned time. The buildings where the tribunals were held, the public granaries, the barracks, salt warehouses, and works, have been totally destroyed, and every thing they contained is lost: warehouses and workshops, as well as private houses, for the most part, present nothing but ruins and heaps of rubbish. Of 27 ships of war which were in the harbour, 12 have disappeared; two others have been dashed to pieces, and 10 are shattered in such a manner that they are rendered entirely unfit for service; other smaller vessels of different sizes, above 100 in number, have shared the same fate; eighty have been swallowed up; five others, which had just taken in a lading of rice for Fokien, have sunk, and their cargoes, which amounted to 100,000 bushels, are wholly lost. With regard to other vessels, whether small or great, which had not entered the harbour, 10 or 12 of the largest are reckoned to have been swallowed up; those of inferior size, as well as a prodigious number of barks, boats, and other small vessels of different kinds, have disappeared, without leaving the least piece of wreck behind them. As the whole island has been covered with water, the provisions have been either swept away, or spoilt so as to render them prejudicial to the health of those who use them in their present state. The crops are entirely lost. When we shall have been informed of particulars, we shall not fail to give your majesty the earliest intelligence of them.—After having received this letter from Mon-ha-hon, and the other principal officers residing at Tay-ouan, I employed the utmost diligence to give every assistance in my power to this unfortunate island; and I ordered the travelling commissary, and Trey-oner, general of the province, to get particular information of the number of those who have perished, of the houses destroyed, and of the quantity of salt and other provisions that has been lost: I have likewise enjoined them to rebuild with the utmost expedition the tribunals, granaries, and other public edifices; to dispatch proper persons to search for the vessels and ships that have disappeared; to repair those which are not altogether unfit for service, and to send immediately to the neighbouring countries for salt and other necessary provisions: but above all, to ascertain in the most accurate manner the different losses sustained by the inhabitants, and the precise number of people that have perished, in order that I may be able to give the fullest information to your majesty."

Formosa, Formula.

' The emperor of China caused a particular detail of these losses to be published, together with the following letter:

" Tchang-yu, &c. Tchem-hoeï-Thon-Tsong-tou of Fokien, and others, have informed me of the dismal event that hath taken place in the island of Tay-ouan, which is a district of the province of Fokien. They have written to me, that on the 21st of the fourth moon—[Here the emperor repeats what is contained in the preceding letter, and continnes thus]. I command Tsong-tou to get the best information he can of the different losses sustained by the inhabitants of the island, and to transmit the particulars to me, in order that I may give them every assistance to repair them. My intention is, that all the honses which have been thrown down shall be rebuilt entirely at my expence; that those be repaired which are only damaged; and that provisions, and every thing which the people stand in immediate want of, be supplied them. I should feel much pain, were even one among them to be neglected: I therefore recommend the utmost diligence and strictest inquiry, as I am desirous that none of my subjects should entertain the least doubt of the tender affection which I have for them; and that they should know that they are all under my eyes, and that I myself will provide for their wants. With regard to my ships of war, tribunals, and public edifices, let them be restored to their former state with money taken from the public treasury, and let the general account of the whole expence be laid before me."

The missionary who sent this account farther says, From these letters it evidently appears, that this disaster happened in consequence of an earthquake; but he adds, that the volcano which occasioned it must be at a prodigious depth below the sea. He does not pretend to give an explanation of it; he is contented with observing, that the same scene seems to have passed on the island of Formosa as at Lima and Lisbon.

FORMULA, or FORMULARY, a rule or model, or certain terms prescribed or decreed by authority, for the form and manner of an act, instrument, proceeding, or the like.

FORMULA, in *Church History* and *Theology*, signifies a profession of faith.

FORMULA, in *Medicine*, imports the constitution of medicines, either simple or compound, both with respect to their prescription and consistence.

FORMULA, a theorem or general rule, or expression, for solving certain particular cases of some problem, &c. so $\frac{1}{2}s+\frac{1}{2}d$ is a general formula for the greater of two

(A) The hours of the Chinese are double ours: the hour *yn* begins at three in the morning, and ends at five; *ouei* begins at three in the afternoon and ends at five.

Formula ‖ Fornication.

two quantities whose sum is s, and difference d; and $\frac{1}{2}s-\frac{1}{2}d$ is the formula, or general value, for the less quantity. Also $\sqrt{dx-x^2}$, is the formula, or general value, of the ordinate to a circle, whose diameter is d, and absciss x.

FORMULARY, a writing, containing the form or formula of an oath, declaration, attestation, or abjuration, &c. to be made on certain occasions.

There are also formularies of devotion, of prayers, &c. Liturgies are formularies of the public service in most churches.

FORNACALIA, or FORNICALIA, in Roman antiquity, a festival instituted by Numa, in honour of Fornax, the goddess of ovens; wherein certain cakes were made, and offered in sacrifice before the ovens.

FORNICATION (*Fornicatio*, from the *fornices* in Rome, where the lewd women prostituted themselves for money), is whoredom, or the act of incontinency, between single persons; for if either of the parties is married, it is *adultery*. Formerly court leets had power to inquire of and punish fornication and adultery; in which courts the king had a fine assessed on the offenders, as appears by the book of Domesday.

In the year 1650, when the ruling powers found it for their interest to put on the semblance of a very extraordinary strictness and purity of morals, not only incest and wilful adultery were made capital crimes, but also the repeated act of keeping a brothel, or committing fornication, was, upon a second conviction, made felony without benefit of clergy. But, at the Restoration, when men, from an abhorrence of the hypocrisy of the late times, fell into a contrary extreme of licentiousness, it was not thought proper to renew a law of such unfashionable rigour. And these offences have been ever since left to the feeble coercion of the spiritual court, according to the rules of the canon law; a law which has treated the offence of incontinence, nay, even adultery itself, with a great degree of tenderness and lenity; owing perhaps to the constrained celibacy of its first compilers. The temporal courts therefore take no cognizance even of the crime of adultery otherwise than as a private injury. See ADULTERY.

The evils of fornication, which too many wish to consider as no sin, may be judged of from the following particulars.

1. The malignity and moral quality of each crime is not to be estimated by the particular effect of one offence, or of one person's offending, but by the general tendency and consequence of crimes of the same nature. In the present case, let the libertine consider and say, what would be the consequence, if the same licentiousness in which he indulges were universal; or what should hinder its becoming universal, if it be innocent or allowable in him?

2. Fornication supposes prostitution; and by prostitution the victims of it are brought to almost certain misery. It is no small quantity of misery in the aggregate, which, between want, disease, and insult, is suffered by those outcasts of human society who infest populous cities; the whole of which is a general consequence of fornication, and to the increase and continuance of which every act and instance of fornication contributes.

Fornication.

3. Fornication produces habits of ungovernable lewdness, which introduce the more aggravated crimes of seduction, adultery, violation, &c. The criminal indulgences between the sexes prepare an easy admission for every sin that seeks it: they are, in low life, usually the first stage in men's progress to the most desperate villanies; and in high life, to that lamented dissoluteness of principle, which manifests itself in a profligacy of public conduct, and a contempt of the obligations of religion and moral probity.

4. Fornication perpetuates a disease, which may be accounted one of the sorest maladies of human nature, and the effects of which are said to visit the constitution of even distant generations.

The passion being natural, proves that it was intended to be gratified; but under what restrictions, or whether without any, must be collected from different considerations.

In the Scriptures, fornication is absolutely and peremptorily condemned. 'Out of the heart proceed evil thoughts, murders, adulteries, fornication, thefts, false witness, blasphemies; these are the things which defile a man.' These are Christ's own words; and one word from him upon the subject is final. The apostles are more full upon this topic. One well-known passage in the Epistle to the Hebrews may stand in the place of all others; because, admitting the authority by which the apostles of Christ spake and wrote, it is decisive. 'Marriage and the bed undefiled is honourable amongst all men, but whoremongers and adulterers God will judge;' which was a great deal to say, at a time when it was not agreed even amongst philosophers that fornication was a crime.

Upon this subject Mr Paley adds the following observations *.

"The Scriptures give no sanction to those austerities which have been since imposed upon the world under the name of Christ's religion, as the celibacy of the clergy, the praise of perpetual virginity, the *prohibitio concubitus cum gravida uxore*; but with a just knowledge of, and regard to the condition and interest of the human species, have provided in the marriage of one man with one woman an adequate gratification for the propensities of their nature, and have restrained them to that gratification.

"The avowed toleration, and in some countries the licensing, taxing, and regulating of public brothels, has appeared to the people an authorizing of fornication, and has contributed, with other causes, so far to vitiate the public opinion, that there is no practice of which the immorality is so little thought of or acknowledged, although there are few in which it can more plainly be made out. The legislators who have patronized receptacles of prostitution ought to have foreseen this effect, as well as considered, that whatever facilitates fornication, diminishes marriages. And as to the usual apology for this relaxed discipline, the danger of greater enormities if access to prostitutes were too strictly watched and prohibited; it will be time enough to look to that, after the laws and the magistrates have done their utmost. The greatest vigilance of both will do no more, than oppose some bounds and some difficulties to this intercourse. And after all, these pretended fears

* *Moral and Political Philosophy*, p. 246.

fears are without foundation in experience. The men are in all respects the most virtuous in countries where the women are most chaste.

"If fornication be criminal, all those incentives which lead to it are accessaries to the crime: as lascivious conversation, whether expressed in obscene or disguised under modest phrases; also wanton songs, pictures, books; the writing, publishing, and circulating of which, whether out of frolic or for some pitiful profit, is productive of so extensive a mischief from so mean a temptation, that few crimes within the reach of private wickedness have more to answer for, or less to plead in their excuse.

"Indecent conversation, and by parity of reason all the rest, are forbidden by St Paul, Eph. iv. 29. 'Let no corrupt communication proceed out of your mouth;' and again, Col. iii. 8. 'Put filthy communication out of your mouth.'

"The invitation or involuntary admission of impure thoughts, or the suffering them to get possession of the imagination, falls within the same description, and is condemned by Christ, Matt. v. 28. "Whosoever looketh on a woman to lust after her, hath committed adultery with her already in his heart.' Christ, by thus enjoining a regulation of the thought, strikes at the root of the evil."

FORNIX, in *Anatomy*, is part of the corpus callosum in the brain; so called, on account of a distant resemblance to the arches of ancient vaults when viewed in a particular manner.

FORRAGE, in the military art, denotes hay, oats, barley, wheat, grass, clover, &c. brought into the camp by the troopers, for the sustenance of their horses.

It is the business of the quartermaster general to appoint the method of forrage, and post proper guards for the security of the forragers.

FORRES, a borough town of Scotland in the county of Murray, classing with Inverness, Fortrose, and Nairn. It is a small well built town, pleasantly situated on an eminence near the river Findhorn, with 2925 inhabitants in 1811. The country about it has a cheerful appearance, having a few gentlemen's seats. On a hill west of the town are the remains of a castle; and a melancholy view of a number of sand-hills, that now cover that tract of land which was formerly the estate of a Mr Cowben in the parish of Dyke. This inundation was occasioned by the influx of the sea and the violence of the wind. It had been the custom to pull up the bent, a long spiry grass near the shore, for litter for horses, by which means the sand was loosened, and gave way to the violence of the sea and wind, which carried it over several thousand acres of land. The people having been prevented from pulling up any more of the grass, the progress of the sand is now nearly stopped, and the sea has retired; but the wind has blown some of the sand from the hills over Colonel Grant's land, and destroyed near 100 acres. A sand bank, which is all dry at low water, runs out from this place for several miles into the Murray Frith. Some of the land, which has been long forsaken by the water, is now beginning to be useful again, and is turned into grazing land. At Forres, coarse linen and sewing thread are made. East from the town, and on the left hand side of the road, is a remarkable obelisk, which is said to be the most stately monument of the kind to be seen in Europe. It has been the subject of many able pens; but totally overlooked by Dr Johnson, who says, "At Forres we found good accommodation, but nothing worthy of particular remark."—It is thus described by Mr Cordiner, in a letter to Mr Pennant: "In the first division, underneath the Gothic ornaments at the top, are nine horses with their riders marching forth in order: in the next is a line of warriors on foot, brandishing their weapons, and appear to be shouting for the battle. The import of the attitudes in the third division is very dubious, their expression indefinite. The figures which form a square in the middle of the column are pretty complex but distinct; four serjeants with their halberts guard a canopy, under which are placed several human heads which have belonged to the dead bodies piled up at the left of the division; one appears in the character of executioner severing the head from another body; behind him are three trumpeters sounding their trumpets, and before him two pair of combatants fighting with sword and target. A troop of horse next appears, put to flight by infantry, whose first line have bows and arrows; the three following, swords and targets. In the lowermost division now visible, the horses seem to be seized by the victorious party, their riders beheaded, and the head of their chief hung in chains or placed in a frame; the others being thrown together beside the dead bodies under an arched cover. The greatest part of the other side of the obelisk, occupied by a sumptuous cross, is covered over with an uniform figure, elaborately raised, and interwoven with great mathematical exactness. Under the cross are two august personages, with some attendants, much obliterated, but evidently in an attitude of reconciliation; and if the monument was erected in memory of the peace concluded between Malcolm and Canute, upon the final retreat of the Danes, these large figures may represent the reconciled monarchs. On the edge below the fretwork are some rows of figures joined hand in hand, which may also imply the new degree of confidence and security which took place, after the feuds were composed, which were characterized on the front of the pillar. But to whatever particular transaction it may allude, it can hardly be imagined, that in so early an age of the arts in Scotland as it must have been raised, so elaborate a performance would have been undertaken but in consequence of an event of the most general importance; it is therefore surprising that no distincter traditions of it arrived at the era when letters were known. The height of this monument (called *King Sueno's Stone*) above the ground is 23 feet: besides 12 or 15 feet under ground. Its breadth is 3 feet 10 inches by one foot 3 inches in thickness."

FORSTER, John Reinhold, a celebrated German naturalist. See Suplement.

Forster, J. G. A. an eminent naturalist, and son of the preceding. See Supplement.

FORT, in the military art, a small fortified place, environed on all sides with a moat, rampart, and parapet. Its use is to secure some high ground, or the passage of a river, to make good an advantageous post, to defend the lines and quarters of a siege, &c.

Forts are made of different figures and extents, according

cording as the ground requires. Some are fortified with bastions, others with demibastions. Some again are in form of a square, others of a pentagon. A fort differs from a citadel, as this last is built to command some town.

Royal Fort, is one whose line of defence is at least 26 fathoms long.

Star Fort, is a sconce or redoubt, constituted by re-entering and salient angles, having commonly from five to eight points, and the sides flanking each other.

Vitrified Forts, a very singular kind of structures found in the highlands and northern parts of Scotland, in which the walls have the appearance of being melted into a solid mass, so as to resemble the lava of a volcano, for which indeed they have been taken by several persons who have visited them.

These walls were taken notice of by Mr Williams an engineer, who wrote a treatise upon the subject, and was the first who supposed them to be works of art; other naturalists having attributed them to a volcanic origin. These works are commonly situated on the tops of small hills, commanding an extensive view of the adjacent valley or low country. The area on the summit, varying, as is supposed, according to the number of cattle the proprietor had to protect, or the dependents he was obliged to accommodate, is surrounded with a high and strong wall, of which the stones are melted, most of them entirely; while others, in which the fusion has not been so complete, are sunk in the vitrified matter in such a manner as to be quite enclosed with it; and in some places the fusion has been so perfect, that the ruins appear like masses of coarse glass. Mr Williams has not only absolutely determined the walls in question to be the works of art, but has even hazarded a conjecture as to the manner in which they were constructed, and which, according to him, was as follows. Two parallel dikes of earth or sod being raised, in the direction of the intended wall, with a space between them sufficient for its thickness, the fuel was put in, and set on fire. The stones best adapted for the purpose, called the *plum-pudding stone*, are everywhere to be found in the neighbourhood. These were laid on the fuel, and when melted, were kept by the frame of earth from running off; and by repeating the operation, the wall was raised to a sufficient height. This opinion of the stones being thrown in without any order, is thought to be confirmed by the circumstance of there not being anywhere a large one to be seen, nor a stone laid in any particular direction, nor one piece which has not in some degree been affected by the fire. Mr Williams mentions a fact tending to confirm his hypothesis, viz. of a brick kiln situated on the declivity of an eminence, so as to be exposed to the wind, which happening to rise briskly one time when the kiln was burning, so increased the heat, that the bricks were melted, and ran, like a lava, for a considerable way down the hill.

The opinion of Mr Williams has been embraced by several other authors; particularly Mr Freebairn and Dr Anderson, the latter having published two treatises upon these buildings in the Archæologia. In the same work, however, we meet with a paper by the Hon. Daines Barrington, in which the author expresses quite different sentiments. He observes, that Mr Williams, and the other antiquarians, who suppose the walls in question to be works of art, imagine that the reason of their being constructed in this manner was the ignorance of cement, which in these remote ages prevailed in Scotland: but with respect to this circumstance, he says, that if one side of the wall only was heated, and that to any considerable height, the matter in fusion would in all likelihood drop down to the bottom, without operating as any cement to the loose stones thrown in amongst it. This circumstance of the walls being vitrified only on one side, is indeed remarkable, and takes place in most of the forts of this kind to be met with at present: but with regard to it, Mr Barrington observes, that he himself has been twice in the Highlands of Scotland, and has found very few hills of any height which were clothed with wood; the trouble therefore of carrying it up to the top of such a mountain would be very considerable. But to this it might easily be replied, that we cannot by any means argue from the present state of the hills in the Highlands to their state in a very remote period of antiquity. At that time, it is neither impossible, nor in the least improbable, that most of the hills in Scotland were overgrown with wood; or at any rate, there undoubtedly was plenty of peat, which is still used as fuel in Scotland, and which affords such a strong heat as to be advantageously employed in smelting iron, as we are informed by M. Magellan. A third particular mentioned by Mr Williams is, that these enclosures were intended as places of defence; and in support of this opinion he alleges, that there are dried wells found within most of them. But on this Mr Barrington observes, that shelter from the weather was also necessary, "upon the top of a bleak Scotch hill, whilst whisky (or a succedaneum for it) would be often in greater request than the bare element of water." This objection, however, as well as the last, is evidently very frivolous; for these buildings might have roofs as well as any other; and whatever necessity there might be for whisky occasionally, water was certainly an indispensable requisite.

Mr Barrington having thus given his reasons for dissenting from the opinion of Mr Williams and the antiquaries just mentioned, proceeds to state his own. He tells us, that having travelled for 21 years the most mountainous circuit in Wales, he has frequently observed enclosures of dry stones, particularly a long tract in the western part of Merionethshire, called in the language of the country *Duffryn*, i. e. the *vale*. On first viewing these small enclosures made with walls of thick stones, he was at a loss to imagine how it could be worth while to construct such strong fences for so inconsiderable a piece of ground as they enclosed; but, on examining the adjacent country, he found it almost entirely covered with stones of a similar kind; and, of consequence, the smaller the space to be cleared, the less expensive would be the removal. "For the same reason (says he), such dry walls are often of a great thickness, and sometimes the corners of the enclosures are filled with stones to a great width, this being the only possible means of procuring pasture." To a practice of the same kind our author would ascribe the origin of the works in question: but the objection occurs very strongly, that the walls in Scotland are vitrified, and it is not to be supposed that such trouble

 would

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would be taken with fences made in such a fortuitous manner. This objection, our author owns, would indeed be unanswerable, on the supposition that the vitrification was made on purpose to strengthen the walls of the fortress; but (says he) may not the vitrification have been occasioned by volcanoes, or by what are called *bloomeries*? The same effect may be produced likewise on dry walls of stone by lightning passing along them. The loose stones in either case would not be rejected because they were glassy, and would be piled up in the fence of the enclosure: as the great point upon these occasions is to clear the ground, and remove the encumbering stones to the smallest distance. One of the advocates for the designed and not fortuitous vitrification, says, that the pieces he had produced did not resemble what is called *lava*. But every volcano is not necessarily an Etna or a Vesuvius; and consequently the matter disgorged from the crater must perpetually vary both in substance and form. Vitrified masses, larger or smaller, will likewise be produced by the same means. It may be contended, indeed, that pasture thus procured, by clearing the ground, would be more convenient at the bottom or on the sides, than on the top of the hill; but to this I answer, that in rocky countries you must get what pittance you can of soil, and often it will happen that the only detached and removeable stones are on the summit. When such enclosures have been made, they became very convenient for putting cattle into; and hence perhaps some of the wells which Mr Williams hath mentioned."

Our author concludes his dissertation on this subject by observing, that if vitrification answered the purpose of cement, it is very extraordinary that the ancient inhabitants of Scotland did not apply it to the houses or huts in which they constantly lived, but reserved this troublesome and expensive process merely for a fortification, which might not perhaps be used in half a century against an enemy. On this it is almost superfluous to observe, that in the ages of barbarity and bloodshed, in which these enclosures, whether natural or artificial, were supposed to be used as fortresses, war was so frequent, that a defence against an enemy might seem to be necessary every day, instead of once in half a century. Before we proceed further in the argument, however, it will be necessary to give some account of the situation and appearance of these fortresses.

According to Mr Cardonnel, the largest of them is situated on the hill of Knockfarril, to the south of the valley of Strathpeffer, two miles west from Dingwall in Ross-shire. The enclosure is 120 feet long and 40 broad within the walls; strengthened on the outside with works at each end. A range of habitations seems to have been erected against, or under, the shade of the outward wall; of which those on the south side seem to have been higher and larger than those on the north. There are two wells in the middle, which, on being cleared out, filled with water. On the skirts of the hill to the south are many detached buildings; which, from the stratum of dung found on removing the ruins, appear plainly to have been used for securing the cattle. This place seems to have been anciently of consequence, and the residence of some powerful chief, from a road which leads through the hills to the north-west sea. To the east of the works are a number of vitrified ruins, extending for a considerable way along the ridge of the hill. The end next the fort seems to have joined the outer wall, and consisted either of two parallel walls, closed above, with a passage between them under cover, or a high wall broad enough to walk on. In this wall there is the vestige of a break about the middle, over which a bridge has been laid, to be drawn up or removed as occasion might require.

The fort next in consequence to that of Knockfarril is situated on the hill of Craig-Phadrick near Inverness, "which (says Mr Cardonnel) has this peculiar circumstance, that there appears to have been two vitrified walls quite round the area. The inner one seems to have been very high and strong; the outer wall but low: probably the space between was intended for securing their cattle, as there are no remains of dry-stone buildings, such as are found near the rest. Several parts of this outer wall appear quite entire, sticking to the firm bare rock, where it was first run. The area within the inner wall is nearly 80 paces long and 27 broad." Of this we have an account * by Alexander Fraser Tytler, Esq. professor of civil history in the university of Edinburgh, who visited it in the year 1782. The hill itself is a small conical eminence, forming the eastern extremity of that ridge of mountains which bounds Loch Ness on the north-west side. It is situated about a mile to the north of Inverness, and is accessible on two different quarters, viz. the west and south-east; the forming affording entrance by a narrow level ridge adjoining the hills on Loch Ness, and the latter by an easy ascent from the high ground above Inverness. On approaching the hill from the west, we first meet with a road cut through the rock from the bottom to the top, in most places 10 feet broad and nearly as deep; winding, for about 70 feet, with an easy serpentine direction, by which we gain an ascent over a steep rock otherwise quite inaccessible from that quarter. This road, in our author's opinion, is undoubtedly the work of art, and the vitrified matter on the top is the only thing which indicates the effect of fire; there being neither the appearance of pumice-stone, lava, nor basaltes, about the hill otherwise. There is indeed plenty of plum-pudding stone; which some have supposed to be of the nature of volcanic tufa; but this opinion is rejected by our author as erroneous. "But the circumstance (says he) which in my apprehension evinces, in the most satisfactory manner, that these appearances of the effect of fire on the summit of this hill are not the operation of nature, but of art, is the regular order and disposition of those materials, the form of the ground, and the various traces of skill and contrivance which are yet discernible, though considerably defaced either by external violence or the obliterating hand of time." To investigate this matter regularly, he begins with the winding road already mentioned, and which is evidently cut through the rock for the purpose of gaining an easy ascent from the level ridge to the summit, which would otherwise have been impracticable. In ascending by this road, there appears towards the middle on the right hand, a small platform overhanging the passage, and inclining by a very gentle declivity to the very edge of the rock. Four enormous stones are placed upon the platform, and on the edge and extremity

* *Edin. Phil. Trans.* Vol. II. Class II. Art. 11.

extremity of it, which have evidently been guided by art into that position; it being impossible that they could have rested there, had they been rolled down from the higher parts. The obvious reason for placing them in such a position has been, that on an alarm of danger they might be projected into the path below, which could be done by the efforts of a very few men: and when this was done, the passage would be entirely obstructed, or at least rendered so difficult that it could be defended by a few against any number of assailants. Some other large stones are placed on an eminence to the left, probably with a view to block up a hollow channel, by which an enemy might have attempted to ascend. When we come to the top of the hill, a few feet below the rampart which crowns the whole, there appears an outward wall, approaching on the sides of the hill so near the upper rampart, as to have only a trench of 10 or 12 feet wide between them. This outward wall is in some places so low as to be almost level with the rock, though in other places it rises to the height of two or three feet; but even where lowest, it may be traced by a line of vitrified matter sticking fast to the rock all along, and nearly of the same breadth, which is about nine feet. The remains of this wall are strongly vitrified, except in one place on the north side, where, for about 70 yards, the rampart is formed only of dry stones and earth. At the east side, where the hill is more accessible, there is a prodigious mound of vitrified matter, extending itself to the thickness of above 40 feet. At the south-east corner, and adjoining to this immense mound is an outwork, consisting of two semicircular vitrified walls, with a narrow pass cut through them in the middle; which appears to have been another, and perhaps the principal entry to the fort.

The inner wall, surrounding the summit of the hill, encloses an oblong level area of about 75 yards long and 30 broad, rounded at each of the ends like the outward wall. It is of considerable height, and nearly of the same thickness with the outward one.—It has some appearance of having been defended with four turrets or bastions: but the traces are so imperfect, that Mr Tytler does not lay much stress on his observations in this respect; a number of small tumuli of earth, with a stone in the centre, were more discernible. On the east side a portion of the internal space appears separated from the rest by two ranges of stones fixed strongly in the earth, and forming a right-angled parallelogram. "This separation (says our author) is immediately discernible by the eye, from this circumstance, that the whole of the enclosed summit has been most carefully cleared from stones, of which there is not one to be seen, unless those that form this division, and the single one in the middle of the circle of tumuli above mentioned. What has been the design of this separated space, it is difficult to conjecture. It might perhaps have marked the residence of those of a higher rank, or served as a temple for the purposes of devotion." On the east end of the large area on the summit is a well of about six feet in diameter, which has probably been sunk very deep in the rock, though now it is filled up with rubbish to within a yard of the top.

The other fortified hills mentioned by Mr Cardonnel are those of Dun-Evan in the shire of Nairn; Tordun castle, near Fort Augustus; and another on the west side of Gleneves in Lochaber, three miles to the south of Fort William. The Castle hill of Finhaven, in the county of Angus, has likewise some considerable ruins of the same kind.

Dun-Evan and the hill of Finhaven have likewise been visited by Mr Tytler, who gives an account of them in the paper already quoted; of which the following is an abstract. "On the summit of the hill of Dun-Evan, whose name implies that it had been originally a place of defence, are the remains of two walls surrounding an oblong space like that of Craig Phadrick already described, but somewhat smaller in size. [Mr Cardonnel says that it is about 70 paces long and 30 broad]. There are likewise the traces of a well in the enclosed area; and at the east end are the remains of a prodigious mass of building, much more extensive than that on Craig Phadrick." Here, however, our author could not perceive any marks of fire; and Mr Williams owns that the vitrified ruins here are more wasted than on Knockfarril or Craig Phadrick. But with regard to the vitrifications here, our author is inclined to suppose Mr Williams to have been entirely in a mistake. On the Castle hill of Finhaven, however, the vitrified remains are very visible all round the summit, which is cleared of stones and levelled, unless at one end, where there is a great hollow space separated from the rest of the area, and probably destined exclusively for the keeping of cattle. The enclosed area is about 140 yards long, and upwards of 40 broad.

Besides these fortifications, the hill of Noth affords a remarkable appearance of the same kind: of which Mr Cordiner gives the following description, not from his own observations, but those of a gentleman of credit who visited the place. "On the top of the hill there is an oblong hollow, as I could guess, of about an English acre, covered with a fine sward of grass: in the middle toward the east end of this hollow is a large and deep well. The hollow is surrounded on all sides with a thick rampart of stones. On three sides of this rampart, from 8 to 12 feet thick, is one compact body of stones and minerals which have been in a state of fusion, resembling a mixture of stone and iron-ore, all vitrified, calcined, and incorporated. On the north side the rampart consists of broken pieces of rock, which have the appearance of having been torn to pieces by some extraordinary violence. If the calcined compact wall exists under them, it is not at present visible."

Such are the descriptions of the most remarkable of these curious fortifications which of late seem to have engaged the attention of the learned in a considerable degree. We have already taken notice, that by some they are supposed to be the works of art, by others the productions of a volcano. Mr Cardonnel adopts the opinion of Mr Williams as the most probable, both with respect to their use and manner of construction. Mr Tytler takes notice of the remarkable difference of opinion among those who have viewed the places in question. "It is curious to remark (says he) how the same appearances, to different observers, lead to the most opposite opinions and conclusions. The two gentlemen above mentioned (Mr Williams and Dr Anderson) seem not to have entertained the small-

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est doubt, that the vitrified materials on the tops of these hills were the vestiges of works of art, and the remains of structures reared for the purposes of security and defence. The bishop of Derry, when on a tour to the north of Scotland, visited the hill of Craig Phadrick near Inverness, and expressed his opinion, that the mounds of vitrified matter were not the remains of any artificial work, but the traces of an ancient volcano. In the Phil. Trans. of the Royal Society of London for 1777, Part II. N° 20. is an account of *Creek Faterick*, there termed *a Volcanic hill near Inverness*, in a letter from Thomas West, Esq. to Mr Law, F. R. S. in which the writer does not hesitate to pronounce this hill an extinguished volcano; and having sent specimens of the burnt matter for the inspection of the Royal Society, the secretary subjoins a note to the paper, intimating, that these specimens having been examined by some of the members well acquainted with volcanic productions, were by them judged to be real lava. Such was likewise the opinion of the late Andrew Crosbie, Esq. who, in an account which he gave to the Philosophical Society of Edinburgh in 1780, offered some very curious conjectures with regard to the process of nature, by which he supposed the whole of this hill to have been thrown up from the bottom of the sea by the operation of intestine fire.

Mr Tytler agrees with those who think the vitrified structures to be artificial works: but he differs from Mr Williams and others, who think that they were vitrified on purpose for cementing the materials together. His reason for this is, that the number of forts that show marks of vitrification, is inconsiderable when compared with those that do not. He therefore considers the vitrification as accidental; and that it must have been accomplished in the following manner. In the rude state in which we must suppose Scotland to have been in early times, it is very probable that their buildings, both for habitation and defence, would be frequently constructed of loose stones of an irregular shape; of which, by themselves, it would scarce be possible to fabricate a wall of any tolerable strength. Hence it became necessary to use wood as well as stone in their construction. This kind of building, then, in our author's opinion, was begun by raising a double row of pallisades or strong stakes in the form of the intended structure, in the same way as in that ancient mode of building described by Palladio under the name of *riempiuta à cassa*, or coffer-work. These stakes were probably warped across by boughs of trees laid very closely together, so as to form two fences running parallel to each other at the distance of some feet, and so close as to confine all the materials of whatever size that were thrown in between them. Into this intermediate space, Mr Tytler supposes, were thrown boughs and trunks of trees, earth and stones of all sizes, large or small as they could quarry or collect them. Very little care would be necessary in the disposition of these materials, as the outward fence would keep the mound in form. In this way it is easy to conceive that a very strong bulwark might be reared with great dispatch; which, joined to the natural advantage of a very inaccessible situation, and that improved by artful contrivances for increasing the difficulty of access, would form a structure capable of answering every purpose of security or defence. The most formidable attack against such a building would be fire, which would no doubt be always attempted, and often with success, by an enemy who undertook the siege. If the besiegers prevailed in gaining an approach to the ramparts, and, surrounding the external wall, set fire to it in several places, the conflagration must speedily have become universal, and the effect may be easily imagined. If there happened to be any wind at the time to increase the heat, the stony parts could not fail to come into fusion; and as the wood burnt away, sinking by their own weight into a solid mass, there would remain a wreck of vitrified matter tracking the spot where the ancient rampart had stood; irregular, and of unequal height, from the fortuitons and unequal distribution of the stony materials of which it had been composed. This conjecture appears very probable from their appearance at this day. They do not seem to have ever been much higher than they are at present, as the fragments that have fallen from them, even where the wall is lowest, are very inconsiderable. The durable nature of the materials would prevent them from suffering any changes by time; though from the gradual increase of the soil, they must in some places have lost considerably of their apparent height, and in others been quite covered. Mr Williams, in making a cut through the ramparts at Knockfarril, found in many places the vitrified matter covered with peat moss half a foot thick.

In confirmation of this opinion, our author likewise urges that in the fortification on Craig Phadrick, a large portion of the outward rampart bears no marks of vitrification. The reason of this seems to be, that the steepness of the hill on that side renders a low fence of stones and turf sufficient; and no wood had probably been employed in its construction. "It appears therefore highly probable (concludes our author), that the effect of fire upon these hill fortifications has been entirely accidental; or to speak more properly, that fire has been employed not in the construction, but towards the demolition of such buildings: and for the latter purpose it would certainly prove much more efficacious than for the former. It is much to be doubted, whether it would be at all possible, even in the present day, by the utmost combination of labour and of skill, to surround a large space of ground with a double rampart of stones compacted by fire, of such height and solidity as to answer any purpose of security, or defence against an enemy. Any structure of this kind must have been irregular, low, fragile, easily scaled, and quite insecure; a much weaker rampart, in short, than a simple wall of turf or wooden pallisade. The vestiges yet remaining, as I have already observed, give no room to suppose that the vitrified mound has ever been much more entire than it is at present. The effect of fire upon structures reared in the manner I have supposed them to have been, will account most perfectly for their present appearance. It was from necessity that the builders of these fortifications betook themselves to a mode of structure so liable to be destroyed by fire. In those parts where stones could be easily quarried, of such size and form as to rear a rampart by themselves of sufficient strength and solidity, there was no occasion to employ wood or turf in its construction; and it was therefore proof against all assaults

Vitrified Forts.

saults by fire. Such are the ramparts which appear on the hill of Don Jardel, Dun-Evan, and many others, on which there is not the smallest appearance of vitrification. But on Craig Phadrick, and the other hills, above dscribed, where, from the nature of the rock, the stones could be procured only in irregular and generally small fragments, it was necessary to employ some such mode of construction as I have supposed; and these ramparts, though solid and well calculated for defence against every attack by force or stratagem, were not proof against an assault by fire."

Mr Cordiner is of opinion, that the vitrifications in question cannot have been the works of art, and ridicules the contrary hypothesis; though without adducing any argument against it. The hill of Noth is by him supposed to have been a volcano. He describes it as "a most majestic mountain, in general brown, with moss and heath, interspersed with bare rock, in many places crumbling down. The highest part of it is a circular hill, whose verdure, as well as height, distinguishes it from the rest of the mountain. This is called the *Top of Noth;* and bears the strongest resemblance to every description of a volcanic mount. At the distance of many miles, one can distinguish those ridges which are the boundaries of the crater, indicating the hollow in the top." The gentleman from whom Mr Cordiner received the account of the vitrifications on the summit, informs us, that on first seeing specimens of them, he imagined that they had been pieces of stone calcined by the burning down of a castle; as he had found something very like them on the castle-hill at Cullen, in parts where the sward of grass was broken: but on reaching the top, and viewing the appearances on it already described, he altered his opinion. "That men hardly beset (says he) might climb up with some provisions to this as a place of refuge, is probable: but that, on a barren mountain top, far from cultivated ground, half a day's journey from the plain; that there, in any period of society, man should have been tempted to build that amazing rampart, is not to be imagined: they have found it a natural and extensive fortress, and in critical circumstances have made use of it accordingly. That it has been occupied as a place of strength and of refuge, is very evident; for, some hundred yards lower down on the hill, there are the remains of another rampart or wall, consisting of loose stones piled together without any cement, carried quite round the hill. This last has been built for an additional defence to those who made their abode on the top. The top of Noth, for two-thirds downwards, is covered with a green sward; below that, it is brown with heath: this is the very reverse of the adjacent mountains; and the greater verdure of the upper part I imputed to a new soil created by the ashes of the volcano. The opening, called a *well*, I suppose to have been the latest crater. About a mile south, down towards the lower grounds of the *Cabrock*, there is a very pretty regular green hill, which I ascribe to a later eruption than those which may have formed the contiguous hills now covered with heath. There is an extraordinary luxuriant spring of water rushes out at once from the side of the hill of Noth; which is likewise some confirmation of the opinion that a volcano has some time existed there, which has occasioned great hollows and reservoirs of water in the heart of the mountain. And the wild irregularities of nature through all the Cabrock, the hideous and strange projection of rocks from the sides of the hills, would seem to indicate some vast convulsions which the earth must have suffered in these parts.

"The traces of ancient volcanoes (says Mr Cordiner) are far from being unfrequent in Scotland. The hill of Finhaven is one instance; and not only abundant in this species of lava, but with *tarras*, or the *pulvis puteolanus*, an *amalgama*, as Condamine calls it, of calcined stones mixed with scorias and iron rust reduced to powder. The hill of Beregonium, near Dunstaffnage castle, is another, yielding vast quantities of pumice or scoria of different kinds; many of which are of the same species with those of the volcanic Iceland. The noble assemblage of basaltic columns at Staffa, those in the isle of Sky, and the rock Humble, are but so many evidences of the ancient volcanoes of this country. And finally, the immense stratum of pumex vitreus or Iceland agate, on the hill of Dun-fuin in Arran, is the last proof I shall bring in support of the question."

On this dispute we can only observe, that whatever side we embrace, the difficulties seem to be very great, nay almost insurmountable. When we consider the great thickness of the walls on the top of Noth, from 8 to 12 feet, and the vast mound of vitrified matter, no less than 40 feet in breadth, mentioned by Mr Tytler, we can scarce conceive it possible that less than a volcanic fire could be able to form them. We may easily allow, that, in the way this gentleman mentions, there might be considerable vitrifications formed; but that such immense masses should be brought into perfect fusion by the small quantity of fuel which could be put round them in pallisades, or intermixed with the materials themselves, will be incredible to every one acquainted with the extreme difficulty with which stones of any magnitude are brought into complete fusion. We see even in the insides of furnaces, though sometimes built of no more infusible materials than common brick, no such effects follow. There is a slight vitrification indeed, but it scarcely ever penetrates to the depth of an inch or two, though very violent fires are kept up for a much longer time than we could suppose the wood surrounding those walls to require for its being consumed. In conflagrations, where houses are consumed, which are the only similar examples we have, no such effect is perceived. Even in the great fire at London in 1666, where so many buildings were destroyed, we do not hear of their walls being vitrified, though the materials of many of them were undoubtedly as fusible as the rocks and stones of Craig Phadrick, or the Top of Noth. If, on the other hand, we reject this, and adhere to the volcanic hypothesis, our difficulties are equally great. For where shall we find, in any other part of the world, an example of volcanoes ejecting lava in the form of walls enclosing a regular area? This would be attributing such a singularity to the volcanoes of Scotland as the most extravagant imagination cannot admit. We must therefore conclude, that though these ruins are certainly the works of art, we have not yet sufficient data to decide the question with respect to their construction, but that the subject requires a farther investigation.

In the paper already quoted, Mr Tytler observes, that "these ancient fortifications present a more curious and interesting object of speculation, than those uncertain and indeed fruitless conjectures as to the mode in which they have been reared." This, he justly observes, must have been before the use of mortar was known; for as the country abounded in limestone, and the builders certainly would exert all their powers in giving them a proper degree of strength, it would undoubtedly have been used. Hence we are led to ascribe to these a very considerable degree of antiquity; for as the Britons were taught the use of mortar by the Romans, it is probable that we must date the origin of the structures in question before the time of the invasion of that people, or at least soon after it: so that we must look upon them to be more than 1650 years old; but how far beyond that period we are to search for their origin, does not appear. "All that we can conclude with certainty (says our author) is, that they belong to a period of extreme barbarism. They must have been constructed by a people scarcely removed from the state of savages, who lived under no impression of fixed or regulated property in land; whose only appropriated goods were their cattle; and whose sole security, in a life of constant depredation, was the retreat to the summits of those hills of difficult access, which they had fortified in the best manner they could. As the space enclosed was incapable of containing a great number of men, especially if occupied in part by cattle, it is presumed, that these retreats were formed chiefly for the security of the women and children of the canton, and of their herds. They could be defended by a few men, while the rest of the tribe were engaged with their enemies in the field."

Our author concludes his dissertation with a conjecture, that the forts in question were constructed, not only before the Roman invasion, but before the introduction of the rites of the Druids into Britain.

FORTALICE, in *Scots Law*, signified anciently a small place of strength, originally built for the defence of the country; and which on that account was formerly reckoned *inter regalia*, and did not go along with the lands upon which it was situated without a special grant from the crown. Now, fortalices are carried by a general grant of the lands; and the word is become synonymous with manor-place, messuage, &c.

FORTAVENTURA, one of the Canary islands, 50 miles long, and from 8 to 24 broad, fertile in corn and excellent fruits; and remarkable for its numerous breed of goats and prodigious quantity of goat-milk cheese. The number of inhabitants amounts to 100,000. W. Long. 14. 32. N. Lat. 28. 4.

FORTESCUE, Sir John, lord chief justice of the King's Bench, and lord high chancellor of England, in the reign of King Henry VI. was descended from the ancient family of Fortescue, in the county of Devon. He studied the municipal laws of England in Lincoln's Inn, of which he was made one of the governors in the fourth and seventh years of the reign of King Henry VI. In 1430, he was called to the degree of a serjeant at law, and in 1441 was constituted the king's serjeant. The following year he was made lord chief justice of the King's Bench; in which honourable station he continued till near the end of that king's reign, who, showed him many particular marks of his favour, and advanced him to the post of lord high chancellor of England. During the reign of King Edward IV. he followed the fortunes of the house of Lancaster, and was many years in exile with Queen Margaret and Prince Edward her son. At length they having a prospect of retrieving their desperate fortunes, the queen and prince returned to England, and Sir John Fortescue, with many others, accompanied them; but soon after the decisive battle of Teweksbury, he was thrown into prison and attainted, with other Lancastrians; but found means to procure his pardon from Edward IV. He wrote, 1. A learned commentary on the politic laws of England, for the use of Prince Edward; to one edition of which Mr Selden wrote notes. 2. The difference between an absolute and limited monarchy, as it more particularly regards the English constitution (which was published, with some remarks, by John Fortescue, afterwards Lord Fortescue, in 8vo, in 1714; and a second edition was published with amendments, in 1719): And several works, which still remain in manuscript. He died near 90 years of age; and was buried in the parish church of Ebburton, where a monument was erected to his memory, in 1677, by one of his descendants.

FORTH, one of the most noble and commodious rivers in Scotland. It takes its rise near the bottom of Ben-Lomond; and running from west to east, receives in its passage many considerable streams, deriving their waters from the eminences in the midland counties of North Britain. Between Stirling and Alloa, the Forth winds in a most beautiful and surprising manner; so that, though it is but four miles by land, it is 24 by water between those two places. Below Alloa the river expands itself to a great breadth between the counties of Lothian and Fife, till at Queensferry it is contracted by promontories shooting into it from both coasts; so that, from being four or five, there it is not above two miles broad. In the middle of the channel lies a small island called *Inchgarvy*, which has a spring of fresh water: upon the island there is an ancient fort, which has been lately repaired; and if there were either forts or blockhouses on the opposite promontories, that part of the river which lies between Alloa and Queensferry would be as secure and convenient a harbour as could be desired. A little below this, near the north shore, lies Inchcolm, on which are the remains of an ancient monastery of considerable extent; and opposite to Leith stands the island of Inchkeith, formerly fortified, but now furnished with a light-house. Below Queensferry the north and south shores receding, the body of the water gradually enlarges till it becomes two or three leagues broad, affording several safe harbours on both sides, and excellent roads throughout, unembarrassed with latent rocks, shoals, or sands; and allowing secure anchorage to the largest ships within a league of the coast in almost any part of the Frith, and to vessels of a smaller size within a mile or less. The Firth, or (as it is commonly written) the *Frith*, of Forth, is, at the mouth of it, from North Berwick to Fifeness, full five leagues broad; having the little island of May (on which there is a light-house, and there might also be a fort) in the middle of it, and to the west of this the rocky island of Bass; notwithstanding

Forth.

standing which, the largest fleet may enter and sail up it many miles with the utmost facility and in the greatest safety. In 1781, Admiral Parker's fleet lay some weeks opposite to Edinburgh, accompanied by 500 sail of merchantmen, the whole in view of the city and castle.

The Forth was known to the ancients by the name of *Bodotria*, or (as Ptolemy calls it) *Boderia*, and has been ever famous for the number of its havens: some of which are, indeed, in their present condition, scarce worthy of that name. It is navigable for merchantmen as high as Alloa, 50 miles from the sea; and for coasters as far as Stirling, 24 miles further by water, though only four by land in a direct line, as already observed. The tide flows only a full mile above Stirling to a place called *Craigforth*, where the proprietor intercepts the passage of the salmon by a cruive or wear, very injurious to the large tract of country which stretches as far as Lomond westward. The river from Stirling to the bridge of Aberfoil, at the entrance into the West Highlands, is only passable for man or horse at few places, and these in dry seasons. It glides gently through a dead flat, from Gartmore eastward; "and on these accounts (says Mr Knox*) it might be made navigable for barges, at a trifling expence to the proprietors of the lands, an improvement much wanted in a rich, extensive, and populous valley, without market towns, coal and lime. Supposing this work to be executed, of which there is some probability, the whole extent of navigation on the Forth, will, including all its windings, exceed 200 miles, through a coast of nearly 100 miles; fertile, populous, industrious; and from Stirling eastward, almost lined with towns, anciently the seats of commerce and navigation, till they were ruined by the English depredations; in which miserable state some of them still remain, while others begin to resume the appearance of business. The principal object of these towns was the fisheries; which they prosecuted with great vigour as far as Iceland, till the time of the Union, from which period the eastern fisheries gradually dwindled away; and the poor fishermen, unable to subsist themselves upon air and water, took up the trade of smuggling; but so soon as the fishery laws shall be amended, the salt duties abolished, and an adequate bounty extended to boats as well as busses, these people will readily fall into the track of their ancestors, live by honest industry, and add new vigour to our naval strength. Many of the ports are nearly choked up, others want repairs, which neither the individuals nor the corporations of those decayed places can accomplish. Though the harbours on the Forth are in general small, the depth of water might be made sufficient for vessels of 200 tons burden, which fully answer the purposes of their coasting and Baltic trade; but to obtain this, or even a less depth of water, an aid of 50,000l. would be requisite."

* *View of the British Empire*, vol. ii. 518.

By this river and the Clyde, Scotland is almost divided into two parts. The Forth falls into the east sea below Edinburgh, and has an easy communication with the whole eastern coast of Great Britain; with France, Ostend, Holland, Hamburgh, Prussia, Dantzic, Russia, Sweden, Denmark, Norway, and Greenland. The Clyde falls into the Atlantic ocean below Glasgow, and communicates with the western coast of Great Britain; with Ireland, the south of France, Portugal, Spain, the Mediterranean, America, and the West Indies. These two rivers, thus falling in opposite directions into the two seas which environ our island, and the neck of land between them amounting scarcely to 24 miles, gave rise to the idea of a junction, so as to open a communication across the kingdom, and thereby cut off the long dangerous navigation by the Land's End, and the Pentland Frith: an object of vast utility, and which has been happily accomplished. See Canal.

FORTIFICATION;

THE art of fortifying a town, or other place; or of putting it in such a posture of defence, that every one of its parts defends, and is defended by, some other parts, by means of ramparts, parapets, moats, and other bulwarks; to the end that a small number of men within may be able to defend themselves for a considerable time against the assaults of a numerous army without, so that the enemy in attacking them must of necessity suffer great loss.

The origin and rise of fortification is undoubtedly owing to the degeneracy of mankind. In the first ages of the world, men were dispersed up and down the countries in separate families, as we are told in the histories of the Jews and Scythians, who wandered from one place to another, for the sake of finding pasture for their cattle. These families became in time so numerous as to form large communities, which settled all together in a place; from whence villages and towns had their origin and rise: but they found it was necessary, for the common security, to surround those towns with walls and ditches, to prevent all violences *from their neighbours, and sudden surprises.* This was sufficient for some time, till offensive weapons were invented, and conquering became a fashion. Then walls with loop holes were made at proper distances, in order to screen the defenders against the arrows of the assailants: but finding that, as soon as the enemy got once close to the walls, they could from no part be discovered or repulsed; for this reason they added square towers at proper distances from each other, so that every part of the wall might be defended, by the adjacent sides of the towers. This manner of enclosing towns, however, was found to be imperfect, because there remained still one of the faces of the towers which fronted the field that could not be seen from any other point, and therefore could not be defended. To remedy this, they made the towers round instead of square, imagining this figure to be the strongest to resist the battering engines, as likewise to be better defended from the other parts of the wall.

Notwithstanding the superiority of this method above the former, there remained yet a part of these towers

Vauban's Method.

towers unseen and incapable of being defended; which made them change the figure of the towers again; that is, they made them square as before; but, instead of presenting a face to the field as formerly, they presented an angle; by this means they effectually found out such a disposition of their works that no part could be attacked without being seen or defended by some other part.

This last method was long in use; and would in all probability have continued to this day, if gunpowder had not been found out; but the violence of the guns and mortars soon convinced the world, that such towers and walls were but a weak defence against these thundering engines; and besides, as the nature of the attack was entirely changed, it was also necessary to change that of fortifying likewise.

From that time ramparts were added to the walls, the towers enlarged into bastions, and all sorts of outworks have been added, such as ravelins, counterguards, horn and crown works, and others of the like nature, in order to render the defence in some measure equivalent to the attack.

Notwithstanding all the improvements which have been made in the art of fortifying since the invention of gunpowder, that of attacking is still superior to it; engineers have tried in vain to render the advantages of a fortification equal to those of the attack; the superiority of the besiegers fire, together with the greater number of men, obliges generally, sooner or later, the besieged to submit.

The greatest improvement made in the art of attacking happened in the year 1697, when M. Vauban made first use of ricochet firing at the siege of Ath, whereby the besieged placed behind the parapets were as much exposed to the fire of the besiegers as if there had been none; whereas, before, they had been secure as long as the parapet was not demolished; and the worst is, that there can be no remedy found to prevent this enfilading, without falling into inconveniences almost as bad as those which we endeavour to avoid.

Fortification is either regular or irregular. *Regular* fortification, is that built in a regular polygon, the sides and angles of which are all equal, being commonly about a musket shot from each other. *Irregular* fortification, on the contrary, is that where the sides and angles are not uniform, equidistant, or equal; which is owing to the irregularity of the ground, valleys, rivers, hills, and the like.

Sect. I. *Of Regular Fortification.*

Although authors agree as to the general form in the present manner of fortifying, yet they mostly differ in particular constructions of the parts. As it would be both needless and superfluous to treat of all the different methods hitherto proposed, we shall content ourselves with explaining those only which are most esteemed by the best judges, and have been mostly put in practice.

Construction of M. Vauban's Method.

This method is divided into little, mean, and great; the *little* is chiefly used in the construction of citadels, the *mean* in that of all sorts of towns, and the *great* in particular cases only.

Vauban's Method.

We shall give the construction of the mean, as being most useful; and refer the reader to the table hereafter, for those dimensions which are different in these several fortifications.

Plate CCXXI. fig. 1.

Inscribe in the circle a polygon of as many sides as the fortification is designed to have fronts; let AB (fig. 1.) be one of the sides of half an hexagon, which bisect by the perpendicular CD; divide half AC of it into nine equal parts, and one of these into ten others; then these divisions will serve as a scale to construct all the parts of the fortification, and each of them is supposed to be a toise or fathom, that is, six French feet; and therefore the whole side AB is supposed to be 180 toises.

As the dividing a line into so many equal parts is troublesome and tedious, it is more convenient to have a scale of equal parts by which the works may be constructed.

If therefore, in this case, the radius is taken equal to 180 toises, and the circle described with that radius being divided into six equal parts, or the radius being carried six times round, you will have a hexagon inscribed; AB being bisected by the perpendicular CD as before, set off 30 toises from C to D, and draw the indefinite lines ADG, BDF; in which take the parts AE, BH, each equal to 50 toises: from the centre E describe an arc through the point H, meeting AD in G, and from the centre H describe an arc through the point E, meeting BD in F; or, which is the same, make each of the lines EG, HF, equal to the distance EH; then the lines joining the points A, E, F, G, H, B, will be the principal or outline of the front.

If the same construction be performed on the other sides of the polygon, you will have the principal or outline of the whole fortification.

If, with a radius of 20 toises, there be described circular arcs, from the angular points B, A, M, T, and lines are drawn from the opposite angles, E, H, &c. so as to touch these arcs, their parts, *a b*, *b c*, &c. together with these arcs, will represent the outline of the ditch.

Definitions.

1. The part FEALN, is called the bastion.
2. AE, AL, the faces of the bastion.
3. EF, LN, the flanks.
4. FG, the curtain.
5. FN, the gorge of the bastion.
6. AG, BF, the lines of defence.
7. AB, the exterior side of the polygon.
8. CD, the perpendicular.
9. Any line which divides a work into two equal parts, is called the capital of that work.
10. *a b c*, the counterscarp of the ditch.
11. A, M, the flanked angles.
12. H, E, L, the angles of the shoulder, or shoulder only.
13. G, F, N, the angles of the flank.
14. Any angle whose point turns from the place is called a *salient angle*, such as A, M; and any angle whose

Of Orillons. Plate CCXXI.

whose point turns towards the place a *re-entering angle*, such as b, F, N.

15. If there be drawn two lines parallel to the principal or outline, the one at 3 toises distance, and the other at 8 from it; then the space $y\,x$ included between the principal one and that farthest distant, is called the *rampart*.

And the space $x\,x$, contained by the principal line, and that near to it, and which is generally stained black, is called the *parapet*.

16. There is a fine line drawn within four feet of the parapet, which expresses a step called *banquette*.

N. B. All works have a parapet of three toises thick, and a rampart of 8 to 10, besides their slopes. The rampart is elevated more or less above the level of the place, from 10 to 20 feet, according to the nature of the ground and the particular constructions of engineers.

Of Ravelins. Plate CCXXI.

The parapet is a part of the rampart elevated from 6 to $7\frac{1}{2}$ feet above the rest, in order to cover the troops which are drawn up there from the fire of the enemy in a siege; and the banquette is two or three feet higher than the rampart, or about four feet lower than the parapet; so that when the troops stand upon it they may just be able to fire over the parapet.

17. The body of the place, is all that which is contained within this first rampart: for which reason it is often said to construct the body of the place; which means properly, the construction of the bastions and curtains.

18. All the works which are constructed beyond the ditch before the body of the place are called *outworks*.

TABLE.

	Forts.						Little Fortif.				Mean.		Great.	
Side of Polyg.	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicul.	10	11	$12\frac{1}{2}$	14	15	16	20	21	23	25	30	31	25	22
Faces bast.	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cape of ravel.	25	28	30	35	38	40	54	50	50	52	55	55	60	50

In the first vertical column are the numbers expressing the lengths of the exterior sides from 80 to 260. In the second, the perpendiculars answering to these sides. In the third, the lengths of the faces of bastions: and in the fourth, the lengths of the capitals of the ravelins.

The forts are mostly, if not always, squares: for which reason, the perpendiculars are made one-eighth of the exterior sides; because if they were more, the gorges of the bastions would become too narrow.

The little fortification is chiefly designed for citadels, and are commonly pentagons; the perpendiculars are made one-seventh of the exterior side: the mean is used in all kinds of fortifications from an hexagon upwards to any number of sides; and the great is seldom used but in an irregular fortification, where there are some sides that cannot be made less without much expence, or in a town which lies near a great river, where the side next the river is made from 200 to 260 toises; and as that side is less exposed to be attacked than any other, the perpendicular is made shorter, which saves much expence.

The faces of the bastions are all $\frac{2}{7}$ths of the exterior sides, or nearly so, because the fractions are neglected.

It may be observed in general, that in all squares the perpendicular is $\frac{1}{8}$th of the exterior side, and all pentagons $\frac{1}{7}$th, and in all the rest upward $\frac{1}{6}$th.

1. *Construction of Orillons and retired Flanks.*

Describe the front MPQRST as before, and divide the flank into three equal parts, of which suppose S r to be one: from the opposite flanked angle M draw a line M r, in which take the part $m\,r$ of 5 toises; take likewise R n in the line of defence MR, produced, equal to 5 toises, and join $n\,m$, upon which as a base describe the equilateral triangle $n\,p\,m$, and from the angle p, opposite to the base as centre, is described the circular flank $n\,m$.

And if S r be bisected by the perpendicular 1, 2, and another be erected upon the face ST, at S; the intersection 2 of these two perpendiculars will be the centre of the arc which forms the orillon.

The orillons are very useful in covering the retired flanks, which cannot be seen but directly in the front; and as these orillons are round, they cannot be so easily destroyed as they would be if they were of any other figure.

2. *Construction of Ravelins or Half-moons.*

Fig. 2. Set off 55 toises, from the re-entering angle O of the counterscarp, on the capital OL or on the perpendicular produced, and from the point L draw lines to the shoulders AB; whose parts LM, LN, terminated by the counterscarp, will be the faces, and MO, ON, the semi-gorges, of the ravelin required. Fig. 2.

This is M. Vauban's method of constructing ravelins, according to some authors: and others will have the faces of the ravelin to terminate on those of the bastions within 3 toises of the shoulders; which seems to be the best way, for these ravelins cover the flanks much better than the others.

The ditch before the ravelin is 12 toises, its counterscarp parallel to the faces of the ravelins; and it is made in a circular arc, before the salient angle; as likewise all ditches are in general.

When the ravelins are made with flanks, as in fig. 3. the faces should terminate on those of the bastions, at least 5 toises from the shoulders. Fig. 3.

The flanks are made by setting off 10 toises from the extremities of the faces, from f to h, and from m to l; and from the points h, l, the flanks h, k, l, p, are drawn parallel to the capital LO of the ravelin.

There

Of Tenailles. Plate CCXXI.

There are sometimes redoubts made in the ravelin, such as in fig. 2. which is done by setting off 16 toises from the extremities of the faces on the semi-gorges from N to b, and from M to a; and from the points b, a, the faces are drawn parallel to those of the ravelin: the ditch before the redoubt is 6 toises, and its counterscarp parallel to the faces.

3. *Construction of Tenailles.*

A tenaille is a work made in the ditch before the curtains, the parapet of which is only 2 or 3 feet higher than the level ground of the ravelin. There are three different sorts: the first are those as in fig. 4. which are made in the direction of the lines of defence, leaving a passage of 3 toises between their extremities and the flanks of the bastions, as likewise another of 2 in the middle for a bridge of communication to the ravelin. Fig. 4.

The second sort are those as in fig. 5. Their faces are in the lines of defenee, and 16 toises long, besides the passage of 3 toises between them and the flanks of the bastions; their flanks are found by describing arcs from one shoulder of the tenaille as centre through the other, on which are set off 10 toises for the flanks desired. Fig. 5.

And the third sort are those as in fig. 6. Their faces are 16 toises, as in the second sort, and the flanks are parallel to those of the bastions. Fig. 6.

The use in general of tenailles is to defend the bottom of the ditch by a grazing fire, as likewise the level ground of the ravelin, and especially the ditch before the redoubt within the ravelin, which can be defended from nowhere else so well as from them.

The first sort do not defend the ditch so well as the others, as being too oblique a defence; but as they are not subject to be enfiladed, M. Vauban has generally preferred them in the fortifying of places, as may be seen in the citadel of Lille, at Landau, New Brisac, and in a great many other places.

The second sort defend the ditch much better than the first, and add a low flank to those of the bastion: but as these flanks are liable to be enfiladed, they have not been much put in practice. This defect might however be remedied, by making them so as to be covered by the extremities of the parapets of the opposite ravelins, or by some other work.

As to the third sort, they have the same advantage as the second, and are likewise liable to the same objections; for which reason, they may be used with the same precautions which have been mentioned in the second.

Tenailles are esteemed so necessary, that there is hardly any place fortified without them: and it is not without reason. For when the ditch is dry, the part behind the tenailles serves as a place of arms from which the troops may sally, destroy the works of the enemy in the ditch, oppose their descent, and retire with safety; and the communication from the body of the place to the ravelin becomes easy and secure: which is a great advantage; for by that means the ravelin may be a much better defence, as it can be supplied with troops and necessaries at any time. And if the ditch is wet, they serve as harbours for boats, which may carry out armed men to oppose the passage over the ditch whenever they please; and the communication from the tenailles to the ravelin becomes likewise much easier than it would be without them.

Of Lunettes, &c. Plate CCXXI.

4. *Construction of Lunettes.*

Fig. 7. Lunettes are placed on both sides of the ravelin, such as B, to increase the strength of a place: they are constructed, by bisecting the faces of the ravelin with the perpendicular LN; on which is set off 30 toises from the counterscarp of the ditch, for one of its faces; the other face, PN, is found by making the semi-gorge TP of 25 toises; the ditch before the lunettes is 12 toises, the parapet 3, and the rampart 8, as in the ravelin. Fig. 7.

There is sometimes another work made to cover the salient angle of the ravelin, snch as A, called *bonnet*, whose faces are parallel to those of the ravelin, and when produced bisect those of the lunettes; the ditch before it is 10 toises.

There are likewise lunettes, such as D in fig. 8. whose faces are drawn perpendicular to those of the ravelin, within a third part from the salient angle; and their semi-gorges are only 20 toises. Fig. 8.

These kinds of works may make a good defence, and cost us very great expence; for as they are so near the ravelin, the communication with it is very easy, and one cannot well be maintained till they are all three taken.

5. *Construction of Tenaillons.*

Fig. 9. Produce the faces of the ravelin beyond the counterscarp of the ditch, at a distance MN of 30 toises, and take on the counterscarp of the great ditch 15 toises from the re-entering angle p to q, and draw Nq; then qNMp will be the tenailles required; its ditch is 12 toises, that is, the same as that of the ravelin. Sometimes there is made a retired battery in the front of the tenaillons, as in B; this battery is 10 toises from the front to which it is parallel, and 15 toises long. Fig. 9.

There are commonly retrenchments made in the tenaillons, such as O; their parapets are parallel to the fronts MN, and bisect the side qN; the ditch before this retrenchment is 3 toises; and there is a banquette before the parapet next to the ditch of about 8 feet, called *berm*; which serves to prevent the earth of the parapet (which seldom has any revetment) from falling into the ditch.

It is to be observed, that the ravelin, before which tenaillons are constructed, must have its salient angles much greater than the former construction makes them; otherwise the salient angles of the tenaillons become too acute; for which reason we made the capital of this ravelin 45 toises, and the faces terminate within 3 toises of the shoulders.

6. *Construction of Counterguards.*

Fig. 10. 11. When the counterguard is placed before the ravelin, set off 40 toises on the capital of the ravelin from the salient angle A to the salient angle B, of the counterguard; and 10 from C to D, on the counterscarp of the ditch. Fig. 10. and 11.

When the counterguard is before the bastion, such as in

Of Hornworks, &c.

Plate CCXXI.

in fig. 2. its salient angle F is 50 toises from the salient angle E of the bastion, and the breadth near the ditch of the ravelin 10 toises as before.

The ditch before the counterguards is 12 toises, and its counterscarp parallel to the faces.

Counterguards are made before the ravelin on some particular occasions only; but are frequently constructed before the bastions, as covering the flanks wonderfully well. Some authors, as Mr Blondel and Mr Coehorn, will have them much narrower than they are here.

7. *Construction of Hornworks.*

Fig. 11.

Fig. 12. Produce the capital of the ravelin beyond the salient angle A, at a distance AB of about 80 toises; draw DBE at right angles to AB; in which take BD, BE, each equal to 55 toises; and on the exterior side DE, trace a front of a polygon in the same manner as that of the body of the place, making the perpendicular BF 10 toises, and the faces 30.

The branches D *a*, E *b*, of the hornwork, when produced, terminate on the faces of the bastions, within 5 toises of the shoulders. The ditch of the hornwork is 12 toises, and its counterscarp parallel to the branches; and in the front terminates at the shoulders, in the same manner as the great ditch before the bastions.

The capital of the ravelin before the front of the hornwork is 35 toises, and the faces terminate on the shoulders, or rather 2 or 3 toises beyond them: and the ditch before the ravelin is 8 toises.

There are sometimes retrenchments made within the hornwork, such as S, S; which are constructed by erecting perpendiculars to the faces of the ravelins, within 25 toises of their extremities. This retrenchment, like all others, has a parapet turfed only with a berm of 8 feet before it; as likewise a ditch from 3 to 5 toises broad.

Fig. 13.

Fig. 13. When a hornwork is made before the bastion, the distance DL of the front from the salient angle of the bastion is 100 toises, and the branches terminate on the faces of the adjacent ravelins within 5 toises from their extremities; all the rest is the same as before.

8. *Construction of Crownworks.*

Plate CCXXII. fig. 14.

From the salient angle, A (fig. 14) of the ravelin, as a centre, describe an arc of a circle with a radius of about 120 toises, cutting the capital of the ravelin produced at C; from the point C, set off the cords CB, CF, each of them equal to 110 toises; and on each of which, as an exterior side, construct a front of a polygon of the same dimensions as in the hornwork; that is, the perpendicular should be 18 toises, the faces 30, and the branches terminate on the faces of the bastions within 25 toises of the shoulders.

The ditch is 12 toises, the capital of the ravelin 35, and its ditch 8; that is, the same as in the hornwork.

Fig. 15.

Sometimes the crownwork is made before the bastion, as in fig. 15. The arc is described from the salient angle A of the bastion, with a radius of 120 toises, as before; and the branches terminate on the faces of the adjacent ravelins, within 25 toises of their extremities; the rest of the dimensions and constructions are the same as before.

Of Covert-ways, &c.

Plate CCXXII.

Hornworks, as well as crownworks, are never made but when a large spot of ground falls beyond the fortification, which might be advantageous to an enemy in a siege, or to cover some gate or entrance into a town.

9. *Construction of Covert-ways and Glacis.*

Although we have not hitherto mentioned the covert-way, nevertheless all fortifications whatsoever have one; for they are esteemed to be one of the most essential parts of a modern fortification; and it is certain, the taking the covert-way, when it is in a good condition and well defended, is generally the most bloody action of the siege.

After having constructed the body of the place, and all the outworks which are thought necessary, lines are drawn parallel to the outmost counterscarp of the ditches, at 6 toises distant from it; and the faces *m n*, *m n*, included between that line and the counterscarp, will be the covert-way required.

Fig. 16. There is in every re-entering angle of the counterscarp a place of arms *m*; which is found by setting off 20 toises from the re-entering angle *a*, on both sides from *a* to *b*, and from *a* to *c*; and from the points *b*, *c*, as centres, arcs are described with a radius of 25 toises, so as to intersect each other in *d*; then the lines drawn from this intersection to the points *b*, *c*, will be the faces of the places of arms. Fig. 16.

If lines are drawn parallel to the lines which terminate the covert-way, and the places of arms at 20 toises distant from them, the space *x*, *x*, *x*, between these lines and those which terminate the covert-way will be the glacis.

At the extremities of the places of arms, are traverses made, such as *v*, *v*, which serve to enclose them; these traverses are 3 toises thick, and as long as the covert-way is broad; and a passage is cut in the glacis round them, of about 6 or 8 feet, in order to have a free communication with the rest of the covert-way.

There are also traverses of the same dimensions before every salient angle of the bastion and outworks, and are in the same direction as the faces of those works produced; and the thickness lies at the same side as the parapets.

The passages round these last traverses are likewise from 6 to 8 feet wide.

In each place of arms are two sally ports *zz*, which are 10 or 12 feet wide, for the troops to sally out; in time of a siege, they are shut up with barriers or gates.

10. *Construction of Arrows and Detached Redoubts.*

An arrow is a work made before the salient angles of the glacis, such as A, fig. 16. It is composed of a parapet of 3 toises thick, and 40 long; and the ditch before it 5 toises, terminating in a slope at both ends. The communication from the covert-way into these arrows is 4 or 5 toises wide; and there is a traverse, *r*, at the entrance, of 3 toises thick, with a passage of 6 or 8 feet round it.

A detached redoubt is a kind of work much like a ravelin, with flanks placed beyond the glacis; such as B: they are made in order to occupy some spot of ground

Of Covert-ways, &c. Plate CCXXII. ground which might be advantageous to the besiegers; likewise to oblige the enemy to open their trenches farther off than they would do otherwise.

Their distance from the covert-way ought not to exceed 120 toises, that it may be defended by musket shot from thence.

The gorge *a b* is 40 toises; the flanks *a c*, *b f*, which are perpendicular to the gorge, 10; and the faces *c d*, *f d*, 30: the ditch before it is 6 toises, ending in slopes at both ends; the covert-way 4; the branches of the covert-way are 42 toises long, or thereabouts; the faces of the places of arms *y*, *y*, which are perpendicular to the branches, 10; and the other, which is parallel to them, 14.

The communication from the covert-way into the redoubt, is 5 or 6 toises wide; and there is a traverse made just at the entrance, and another in the middle when it is pretty long. The parapets of this communication terminate in a slope or glacis.

If these redoubts are above 50 toises distant from the covert-way, the besiegers carry their trenches round, and enter through the gorge; by which the troops that are in them are made prisoners of war, if they do not retire betimes; to prevent which, some other outworks should be made to support them.

11. *Construction of Second Ditches and Covert-ways.*

Fig. 17. Fig. 17. When the ground is low, and water to be found, there is often a ditch about 10 or 12 toises made round the glacis; and opposite to the places of arms are constructed lunettes, beyond the ditch: such as D, whose breadth on the counterscarp of the ditch is 10 toises, from *b* to *a*, and from *c* to *d*; and the faces *a* L, *d* L, are parallel to those of the places of arms; the ditch before them is from 8 to 10 toises wide.

The second covert-way is 4 toises, the semi-gorges of the places of arms, *m*, about 15, and the faces perpendicular to the counterscarp; the second glacis is from 15 to 18 toises broad.

This second covert-way has traverses everywhere, in the same manner as the first.

12. *Construction of Profiles.*

A profile is the representation of a vertical section of a work; it serves to show those dimensions which cannot be represented in plans, and is necessary in the building of a fortification. Profiles are generally constructed upon a scale of 30 feet to an inch. It would be endless to describe all their particular dimensions; we shall therefore lay down the principal rules only, given by M. Vauban, on this subject.

1. Every work ought to be at least 6 feet higher than that before it, so that it may command those before it: that is, that the garrison may fire from all the works at the same time, with great and small arms, at the besiegers in their approaches. Notwithstanding this specious pretence, there are several authors who object against it. For, say they, if you can discover the enemy from all the works, they can discover, by the same reason, all the works from their batteries; so that they may destroy them without being obliged to change their situation, and thereby dismount all the guns of the place before they come near it.

But if all works were of the same height, those within cannot be deestroyed, till such time as those before them are taken: guns might be placed in the covert-way and outworks to obstruct the enemy's approach; and when they come near the place, they might be transported into the inner works: and as the body of the place would be much lower, the expence would be considerably diminished. Of Profiles. Plate CCXXII.

But when works are low, they are easily enfiladed by the ricochet batteries, which is a kind of firing with a small quantity of powder, by giving the gun an elevation of 10 or 12 degrees; this might however be partly prevented, by making the parapets near the salient angles, for the space of 8 toises on each side, 5 or 6 feet higher than the rest of the works.

2. The covert-way should be lower than the level ground, otherwise the body of the place must be raised very high, especially where there are several outworks: this is to be understood only when the works exceed each other in height, otherwise it need not be below the level.

3. The bases of all inward slopes of earth should be at least equal to the height, if not more.

4. The bases of all outward slopes of earth, two-thirds of their height.

5. The slopes of all walls, or revetments, should be one-fifth of their height; or one-sixth might perhaps be sufficient: the height of a wall is estimated from the bottom of the ditch, and not from the beginning of its foundation.

6. The slopes of all parapets and traverses are one-sixth of their breadth; that is, 3 feet towards the field; or the inside, where the banquettes should be 3 feet higher than the outside.

7. When the revetment of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a square stone at the top of it projecting 6 inches; and a circular one below, or where the slope begins, of 8 or 10 inches diameter: they go quite round the rampart, and the circular projection is called the *cordon*.

Where the straight part of the wall ends and the slope begins, the wall is always made 5 feet thick; and the counterforts or buttresses reach no higher than the place.

8. When the rampart is partly walled and partly turfed, then one-fifth of the height which is turfed must be added to 5 feet, to get the thickness of the wall above.

And having the thickness of any wall above, by adding one-fifth of its height from the bottom of the ditch, the sum will be the thickness of the wall at the bottom; but if a sixth part is only taken for the slope, then a sixth part must be added.

For instance, suppose a rampart of 30 feet high from the bottom of the ditch, and that 10 of which are to be turfed; then the fifth part of 10, which is 2, added to 5, gives 7 for the wall above; and as this wall is 20 feet high, the fifth of which is 4, and 4 added to the thickness 7 above, gives 11 for the thickness near the foundation.

Fig. 18. represents (in military perspective) the profiles of the body of a place, the ravelin, and covert-way; which gives a clear idea of what is meant by a profile, and from which those of all other works may be easily conceived. Plate CCXXIII. fig. 81.

SECT.

Of Irregular Fortification.

Plate CCXXIII.

Sect. II. *Of Irregular Fortification.*

The most esssential principle in fortification consists in making all the fronts of a place equally strong, so that the enemy may find no advantage in attacking either of the sides. This can happen no otherwise in a regular fortification situated in a plain or even ground: but as there are but few places which are not irregular either in their works or situations, and the nature of the ground may be such as makes it impracticable to build them regular without too great expence; it is so much the more necessary to show in what consists the strength or weakness of a town irregularly fortified, so that the weakest part may be made stronger by additional outworks; as likewise, if such a place is to be attacked, to know which is the strongest or weakest part.

1. *Construction of an Irregular Place situated in an open country.*

If the place to be fortified is an old town enclosed by a wall or rampart, as it most frequently happens, the engineer is to consider well all the different circumstances of the figure, situation, and nature of the ground; and to regulate his plan accordingly, so as to avoid the disadvantages, and gain all the advantages possible: he should examine, whether by cutting off some parts of the old wall or rampart, and taking in some ground, the place can be reduced into a regular figure, or nearly so; for if that can be done without increasing the expence considerably, it should by no means be omitted. Old towns have often towers placed from distance to distance, as Douay, Tournay, and many other places, which are generally made use of, and mended when it may be done. If there is a rampart without bastions or towers, it must be well considered whether bastions may not be added, or if it is not better to make only some outworks: if the ditch about this rampart is not too wide and deep, it would be advantageous to make detached bastions; otherwise ravelins and counterguards must be constructed. Special care must be taken to make all the sides of the polygon as nearly equal as possible, and that the length of the lines of defence do not exceed the reach of musket-shot; but if that cannot be done, those sides which are on the narrowest part should be made the longest.

If it should happen that some of the sides are inaccessible or of very difficult approach, either on account of some precipice, marshy ground, or inundation, they may be made much longer than the others which are of easy access, and the flanks need not be so large as the rest; by doing so there will be some expences saved, which may be used in making the other sides stronger by adding more outworks.

There are few situations but what are more advantageous in some parts than in others; it is therefore the business of an engineer to distinguish them, and to render those sides strong by art which are not so by nature.

If the situation is low and watery, lunettes or tenaillons, and such other small outworks, should be constructed; because they are not of any great expence, and may make a very good defence. But if one side of the place only is low, and running water is to be had, a second ditch and covert-way with lunettes may be made, by observing, that if the first glacis is made to slope, so as to become even with the level of the water in the second ditch; or if the water can be swelled by means of dikes or sluices, so as to overflow the best part of the first glacis, it should be done: for by so doing these works will be able to make a very good defence, since the besiegers will find it a difficult matter to lodge themselves upon this glacis; which cannot be done but within a few toises of the first covert-way, where the besieged are ready to receive them, and to destroy their works with great advantage; whereas the enemy cannot support their workmen but from the second covert-way, which is too far off to be of any great service to them.

But if the situation is of a dry nature, without any water upon it, caponiers should be made in the great ditch, from the curtains to the ravelin, and batteries raised in the entrance of the ditch before the ravelin, whose parapet must slope off into a glacis so as to afford no cover for the enemy behind them. Arrows and detached redoubts are likewise very proper to be used in such a case; and sometimes horn or crownworks, if it should be thought convenient: but these works should never be constructed without an absolute necessity, either to occupy a spot of ground which might be advantageous to the enemy, or to cover some gate or entrance into the town; for they are of great expence, and their defence seems not to be answerable to it.

Most of the places in Flanders are fortified with hornworks, such as Ypres, Tournay, Lisle, and others.

If the place to be fortified is new, and the situation will not admit of a regular construction, particular care must be taken in choosing such a spot of ground as is most advantageous, and least liable to any disadvantages either in the building or in the maintaining of it. All hills or rising grounds should be avoided, which might command any part of the works; marshy grounds, because such situations are unwholesome; or lakes and standing waters for the same reason, excepting a lake is or may be made navigable. Good water should be had either within the place or near it, for it is absolutely necessary for men and cattle: the air should be wholesome; otherwise the continual sickness that may reign in such a place might prevent people to come and live in it, and the garrison would not be in a condition to defend themselves as they ought to do. In short, all the different circumstances attending such an undertaking should be maturely considered before a resolution is taken to fortify any place.

When a situation is fixed upon, the next thing to be considered is the bigness of the town and the number of its outworks; which must absolutely depend upon the consequence such a place is of to a nation. If it is only to guard a pass or entrance into a country, it need not be so large: but if it is to be a place either to promote or to protect trade, it should be large and commodious: the streets should be wide, and the buildings regular and convenient. As to what regards the fortification, its construction should depend on the nature of the situation, and the number of works, on the funds or expence a prince or a nation will be at; which, however, ought to be according to the benefit arising from

Of Irregular Fortification. Plate CCXXIII.

from such a place; for as such undertakings are of very great expence, an engineer cannot be too sparing in his works; on the contrary, the greatest economy should be used both in regard to the number of works and to their construction. The body of the place may have (A) revetments quite up to the top, or only in part and the rest turfed; but as to the outworks, they should have half revetments, or they may be made with turf only; as being not so necessary to prevent the place from being surprised, which may nevertheless make a good defence.

Fig. 19. Fig. 19. is the plan of an octagon, one half of which is similar and equal to the other half; it being supposed, that the situation would not admit of a fortification quite regular. The exterior sides are each 180 toises, and the works are constructed according to our method: but because the sides AB, EF, are weaker than the rest, as has been proved before, we have added tenailles, redoubts in the ravelins, and lunettes, to render them nearly equal in strength with the others; and if counterguards were made before the bastions A and B, it would effectually secure that front. Instead of lunettes, any other works may be made, as may be thought convenient and according to the nature of the ground. If it should be judged necessary to add other outworks to the ravelins all around the place, care must be taken to add likewise more to the fronts AB, EF, in order to render the advantages and disadvantages of attacking on either side equal.

2. *Construction of an Irregular Place situated on a hill or rock.*

In the construction of such places, care must be taken that no neighbouring hill commands any part of the works. The town should always be built on the highest part; but if it should be thought more convenient to place it lower, then the upper part must be fortified with a fort. The situation should be made level as near as possible, by removing the earth from some places to fill up others; and if it cannot well be levelled without extraordinary expence, works must be made on the highest part, so as to command and protect the lower. The works ought to occupy all the upper part of the hill; but if it should be too extensive to be all enclosed, or so irregular as not to be fortified without great inconvenience, the parts which fall without should be fortified with some detached works, and a communication with the place must be made either above or under ground. There should be no cavity or hollow roads within cannon shot round about the place, where the enemy might be able to approach under cover. If there should happen to be a spring near the top of the hill, it should be enclosed in the fortification, or, if that cannot be done, by some work or other; for there is nothing more necessary, and at the same time scarcer, in such situations than water; for which reason there cannot be too much care in providing it; several cisterns are to be made to receive the rain water, and to preserve it; wells should be dug likewise, though ever so deep, the water of which will serve for common use.

Places built on hills or rocks should never be large; for their use is generally to guard passes or inlets into a country, and are seldom useful in traffic; and it is a difficult matter to provide for a large garrison in such situations: neither should any such place be built without some very material reasons; but when it is absolutely necessary, great care and precaution should be taken to render the works as perfect as the situation will admit of, and at the same time to be as frugal in the expence as possible.

3. *Construction of Irregular Fortifications situated near rivers, lakes, or the sea.*

As the intent of building these kind of places is chiefly to facilitate and protect trade, they are of more importance than any other kind, especially in maritime countries, where the principal strength and power depends on them: for which reason, we shall treat of this construction more largely than of any other.

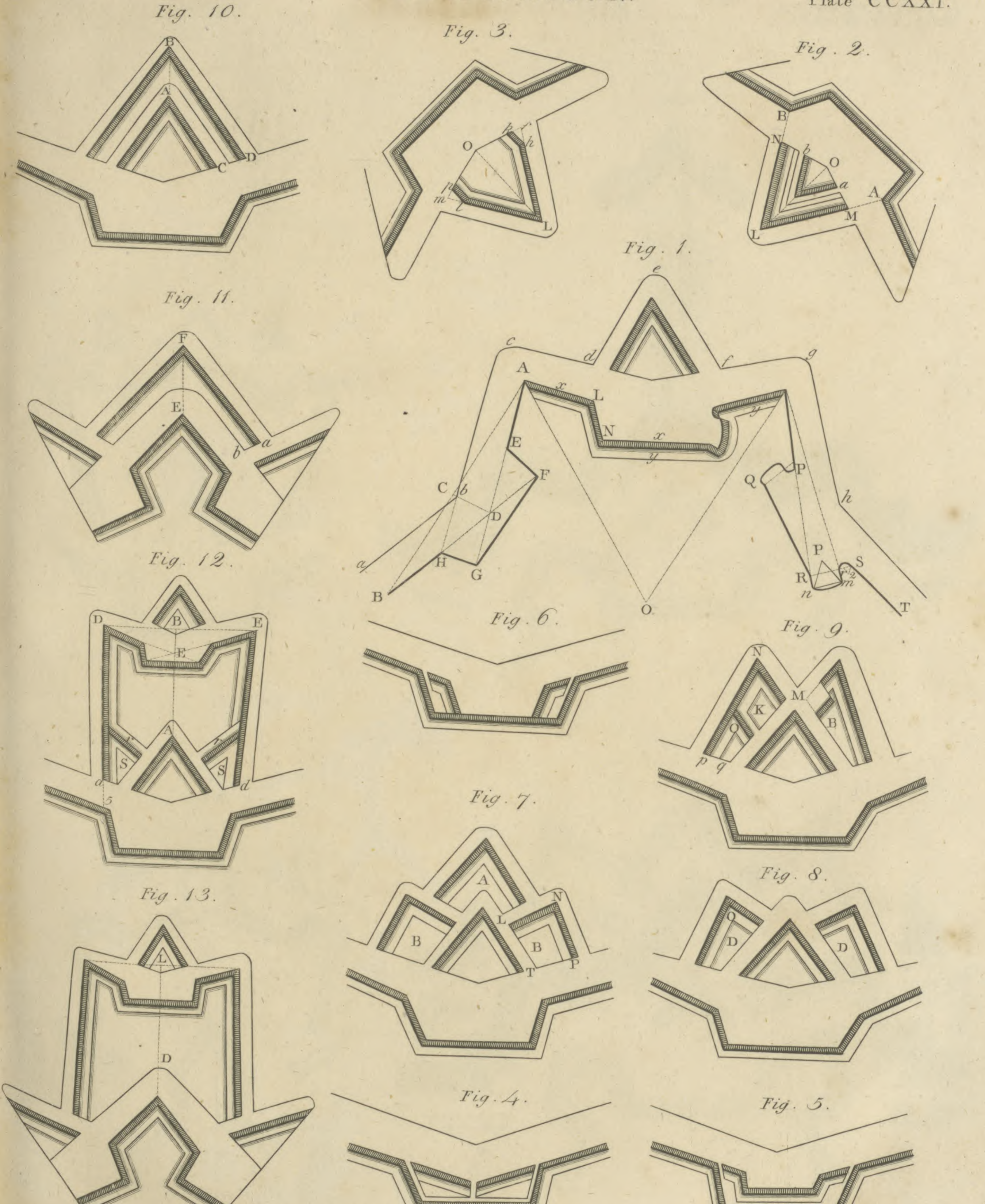
The first thing to be considered is their situation, which ought to be such as to afford a good harbour for shipping, or a safe and easy entrance in stormy weather; but as it is hardly possible to find any where ships may go in and lie secure with all winds, care should be taken to make them safe to enter with those winds which are most dangerous; but it is not sufficient that the harbour is safe against stormy weather, it should likewise be so against an enemy both by land and water, for it often happens, that ships are destroyed where it was imagined they were secure, which is of too great consequence not to be provided against; for which reason, forts or batteries must be built in the most convenient places, to prevent the enemy's ships from coming too near, so as to be able to cannonade those in the harbour, or fling shells amongst them; and if there is any danger of an enemy's approach by land, high ramparts and edifices must be built, so as to cover them.

When a river is pretty large, and it is not convenient for making a harbour without great expence, the ships may ride along the shore: which for that reason, must be made accessible for ships of burden: this may be done by advancing the quay into the river if the water is too shallow, or by digging the river sufficiently deep for that purpose.

And to prevent an enemy from coming up the river, forts must be built on both sides, especially when there are any turnings or windings. Antwerp is such a place; for the Scheldt is sufficiently deep to carry ships of great burden, which may come quite near the town-wall; and several forts are built below it on both sides, so that it would not be an easy matter for an enemy to come up the river.

When the river is but small, so that no ships of burden can come through it, it is sufficient to make it run through some of the works, where proper landing-places are contrived, from whence the goods may be carried into

(A) Revetments are chiefly made to prevent a place from being surprised: outworks do not want to be made so; the taking them by surprise is of no great consequence, except in a siege, when other precautions are used to prevent it.



W. Archibald sc.

Fig. 14.

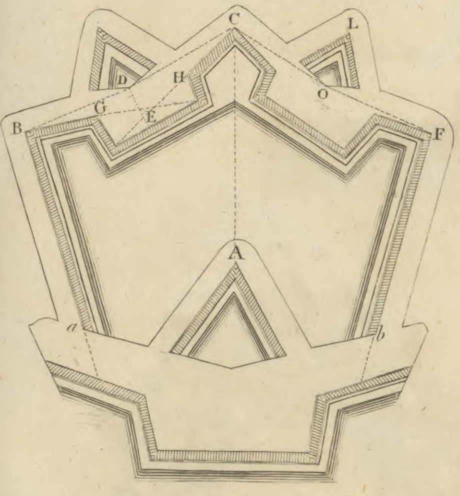


Fig. 15.

Fig. 16.

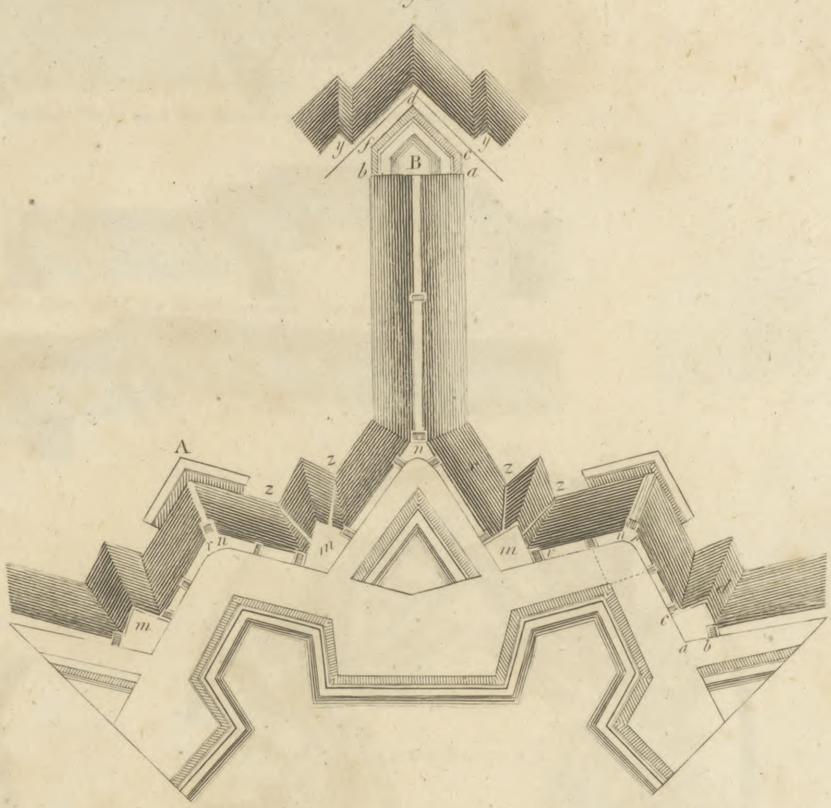
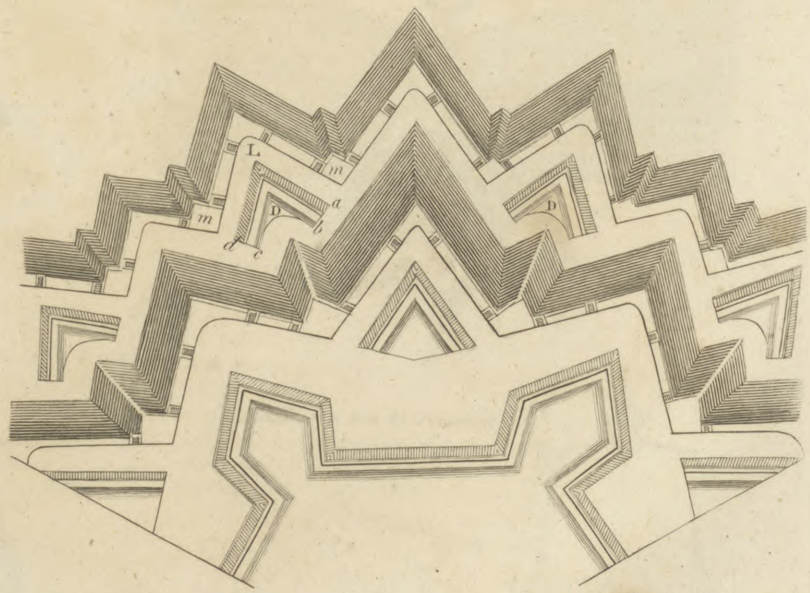


Fig. 17.



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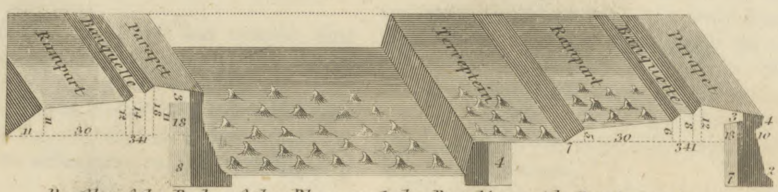
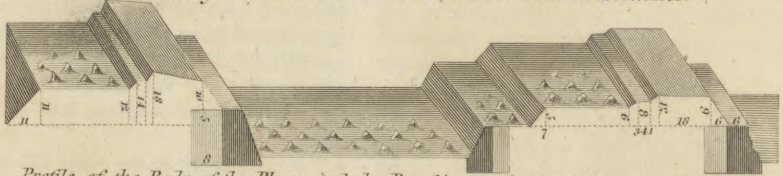
FORTIFICATION.

PLATE CCXXIII.

Fig. 18.



Profile of the Body of the Place and the Raveline with Revetement.



Profile of the Body of the Place and the Raveline with demi Revetement.

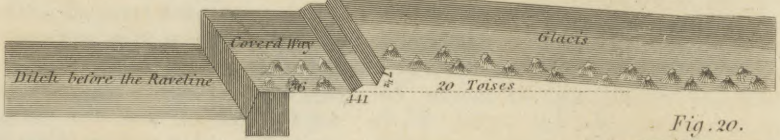


Fig. 19.

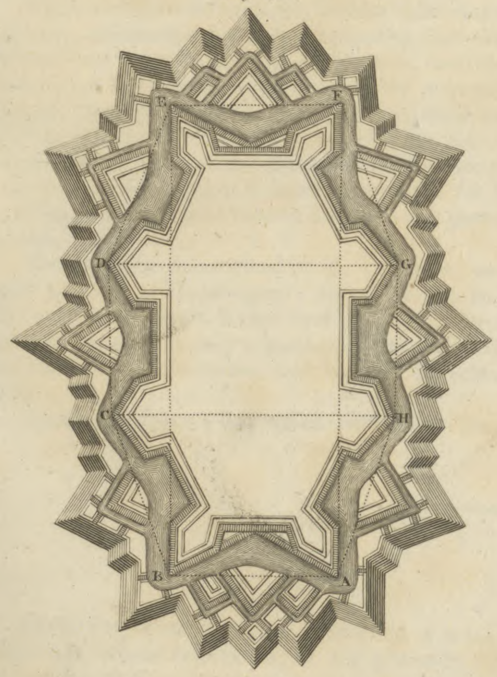


Fig. 20.

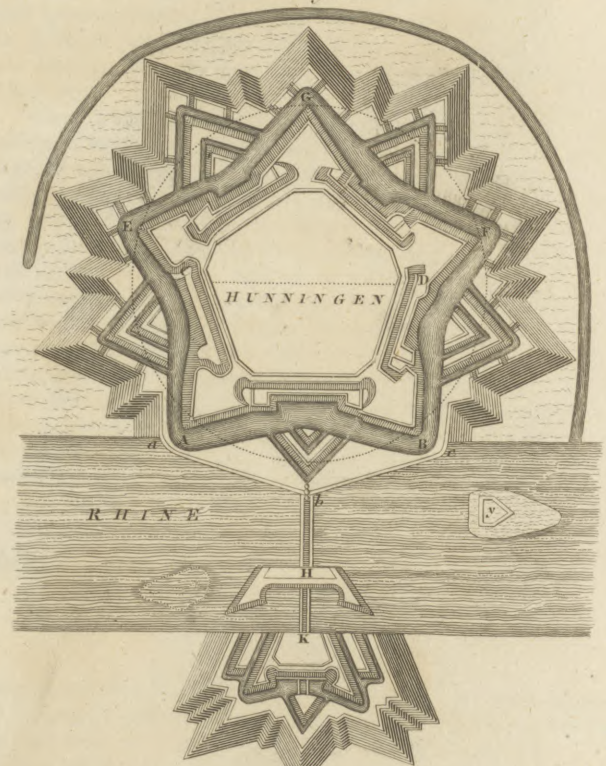


Fig. 1.

Letter Foundery

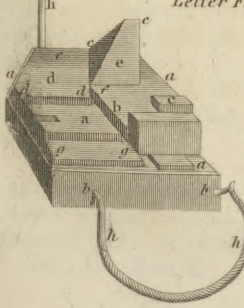
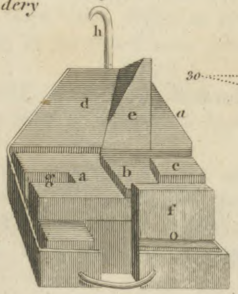
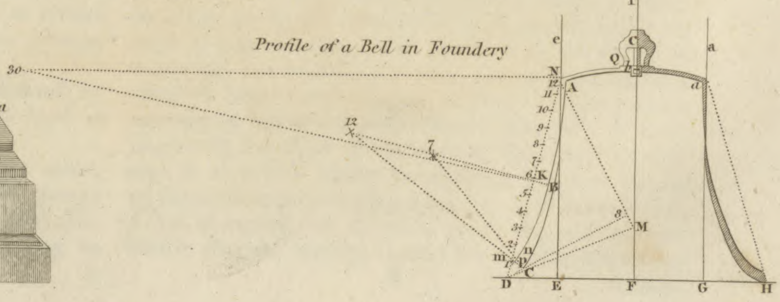


Fig. 2.



FOUNDERY.

Profile of a Bell in Foundery



Eng.d by Watson.

Of Irregular Fortification. Plate CCXXIII. into the place; as at Sarrelouis, where a hornwork is built beyond the Sarre, in the gorge of which the goods are landed.

If the breadth of the river does not exceed 200 yards, it commonly passes through the middle of the town, and proper quays are made on each side; in such a case, the fortification is so contrived, as that the river passes through the curtain, in order to have a bastion on each side to defend the coming in and going out.

When M. Vauban fortified near rivers, he made always the exterior side near the water much longer than any of the others; such as Hunninghen on the Rhine, and Sarrelouis on the Sarre; but for what reason he fortified these places in that manner, has not been told by any author.

But it is plain that the sides which terminate at the river are the weakest; because the besiegers trenches being secured by the river, they may draw most of their troops off, and act therefore with more vigour and strength on the other side: besides, as the strength of a side increases in proportion as the angle of the polygon is greater, by making the side next the river longer, the angles of the extremities become wider, and consequently the adjacent sides stronger.

There are other advantages, besides those mentioned already, which arise from the lengthening that side: for if the river is pretty deep, so as not to be fordable, that side is not liable to be attacked; and by increasing its length, the capacity of the place increases much more in proportion to the expence, than if more sides were made; the centre of the place will be likewise nearer the river, which makes it more convenient for transporting the goods from the water side to any part of the town.

Fig. 20. To illustrate this method of M. Vauban's, we shall give the plan of Hunninghen: this place was built for the sake of having a bridge over the Rhine, for which reason, he made it only a pentagon; the side AB next to the river is 200 toises, and each of the others but 180.

About the space *a b c*, which lies before the front AB, is a stone wall; and the passages *x x* are shut up with sluices, to retain the water in the ditches in dry seasons: and to prevent an enemy from destroying the sluice near the point *c*, whereby the water would run out and leave the ditches dry, the redoubt *y* was built in the little island hard by, in order to cover that sluice; without which precaution the place might be insulated from the river side, where the water is shallow in dry seasons.

The hornwork K beyond the Rhine was built to cover the bridge; but as this work cannot be well defended across the river, the hornwork H was made to support the other.

Before finishing the description of this plan, we shall show how to find the long side AB.

After having inscribed the two sides GE, GF, in a circle, draw the diameter CD, so as to be equally distant from the line joining the points EF that is parallel to it. On this diameter set off 100 toises on each side of the centre; from these points draw two indefinite perpendiculars to the diameter; then if from the points EF, as centres, two arcs are described with a radius of 180 toises, their intersections A and B, with the said perpendiculars, will determine the long side AB, as likewise the other two FB and EA. In like manner may be found the long or short side of any polygon whatsoever.

When a place near a river is to be fortified for the safety of commerce, particular care should be taken in leaving a good space between the houses and the water side, to have a quay or landing place for goods brought by water; it should also be contrived to have proper places for ships and boats to lie secure in stormy weather, and in time of a siege; and as water-carriage is very advantageous for transporting goods from one place to another, as likewise for bringing the necessary materials, not only for building the fortifications, but also the place itself, the expences will be lessened considerably when this convenience can be had; for which reason, places should never be built anywhere else but near rivers, lakes, or the sea; excepting in extraordinary cases, where it cannot be avoided.

Fortin ‖ Fortitude. FORTIN, Forteler, or *Field-fort*, a sconce, or little fort, whose flanked angles are generally 120 fathoms distant from one another.

The extent and figure of fortins are different, according to the situation and nature of the ground; some of them having whole bastions, and others demi-bastions. They are made use of only for a time, either to defend the lines of circumvallation, or to guard some passage or dangerous post.

FORTISSIMO, in *Music*, sometimes denoted by FFF, or *fff*, signifies, to sing or play very loud or strong.

FORTITUDE, a virtue or quality of the mind, generally considered as the same with Courage; though in a more accurate sense they seem to be distinguishable. Courage may be a virtue or a vice, according to circumstances; *fortitude* is always a virtue: we speak of desperate courage, but not of desperate fortitude. A contempt or neglect of danger, without regard to consequences, may be called *courage;* and this some brutes have as well as we: in them it is the effect of natural instinct chiefly; in man it depends partly on habit, partly on strength of nerves, and partly on want of consideration. But fortitude is the virtue of a rational and considerate mind, and is founded in a sense of honour and a regard to duty. There may be courage in fighting a duel, though that folly is more frequently the effect of cowardice; there may be courage in an act of piracy or robbery: but there can be no fortitude in perpetrating a crime. Fortitude implies a love of equity and of public good; for, as Plato and Cicero observe, courage exerted for a selfish purpose, or without

Fortitude. without a regard to justice, ought to be called audacity rather than fortitude.

This virtue takes different names, according as it acts in opposition to different sorts of evil; but some of those names are applied with considerable latitude. With respect to danger in general, fortitude may be termed *intrepidity;* with respect to the dangers of war, *valour;* with respect to pain of body or distress of mind, *patience;* with respect to labour, *activity;* with respect to injury, *forbearance;* with respect to our condition in general, *magnanimity*.

Fortitude is very becoming in both sexes; but courage is not so suitable to the female character; for in women, on ordinary occasions of danger, a certain degree of timidity is not unseemly, because it betokens gentleness of disposition. Yet from those of very high rank, from a queen or an empress, courage in emergencies of great public danger would be expected, and the want of it blamed; we should overlook the sex, and consider the duties of the station. In general, however, masculine boldness in a woman is disagreeable; the term *virago* conveys an offensive idea. The female warriors of antiquity, whether real or fabulous, Camilla, Thalestris, and the whole community of Amazons, were unamiable personages. But female courage exerted in defence of a child, a husband, or a near relation, would be true fortitude, and deserve the highest encomiums.

The motives to fortitude are many and powerful. This virtue tends greatly to the happiness of the individual, by giving composure and presence of mind, and keeping the other passions in due subordination. To public good it is essential; for without it, the independence and liberty of nations would be impossible. It gives to a character that elevation which poets, orators, and historians, have in all ages vied with one another to celebrate. Nothing so effectually inspires it as rational piety; the fear of God is the best security against every other fear. A true estimate of human life; its shortness and uncertainty; the numberless evils and temptations to which by a long continuance in this world we must unavoidably be exposed; ought by no means to discourage or to throw any gloom on our future prospects: they should teach us, that many things are more formidable than death; and that nothing is lost, but much gained, when, by the appointment of Providence, a well spent life is brought to a conclusion.

Let it be considered too, that pusillanimity and fearfulness can never avail us any thing. On the contrary, they debase our nature, poison all our comforts, and make us despicable in the eyes of others; they darken our reason, disconcert our schemes, enfeeble our efforts, extinguish our hopes, and add tenfold poignancy to all the evils of life. In battle, the brave soldier is in less danger than the coward; in less danger even of death and wounds, because better prepared to defend himself; in far less danger of infelicity; and has before him the animating hope of victory and honour. So in life, the man of true fortitude is in less danger of disappointment than others are, because his understanding is clear, and his mind disencumbered; he is prepared to meet calamity without the fear of sinking under it: and he has before him the near prospect of another life, in which they who piously bear the evils of this will obtain a glorious reward.

Fortitude ‖ Fortune.

FORTUNA, a goddess worshipped with great devotion by the ancient Greeks and Romans; who believed her to preside over human affairs, and to distribute wealth and honour at her pleasure. See Fortune.

FORTUNATE islands, in *Ancient Geography*, certain islands (concerning the situation of which authors are not agreed), famous for the golden apples of the Hesperides.—The common opinion is, that they are the *Canary Islands*.

FORTUNE (Τυχη), a name which among the ancients seems to have denoted a principle of fortuity, whereby things came to pass, without being necessitated thereto; but what and whence that principle is, they do not seem to have ever precisely thought. Hence their philosophers are often intimating, that men only framed the phantom *Fortune* to hide their ignorance; and that they call *Fortune* whatever befals a man without his knowing for what purpose. Hence Juvenal (sat. x. ver. 366.) affirms, they were men who made a deity of fortune.

> *Nullum numen abest, si sit prudentia; sed te*
> *Nos facimus, Fortuna, deam, cæloque locamus.*

The ingenious Mr Spence gives another reading of this passage:

> *Nullum numen habes, si sit prudentia; sed te*
> *Nos facimus, Fortuna, deam, cæloque locamus.*

This reading, he thinks, agrees best with the context: Juvenal says, ver. 356, that the two things we should pray for are good health and good sense; that we might be the authors of our own happiness if we pleased, ver. 363.; that virtue is the only way to true happiness, ver. 364.; that if we ourselves are prudent, Fortune has no power over us; and that, in truth, she is no goddess at all, and has only usurped a seat in heaven from the folly of mankind, ver. 366. Fortune was not considered as a deity by the old Romans, but was made so by the devotion and folly of the vulgar; and Mr Spence says, that he has seen an ancient gem, in which Cybele, the mother of the gods, is represented as turning away her head from Fortune, in an attitude of disowning and rejecting her; (Polymetis, p. 150, 154, &c.)

According to the opinion of the heathens, therefore, fortune in reality was only the arrival of things in a sudden and unexpected manner, without any apparent cause or reason: so that the philosophical sense of the word coincides with what is vulgarly called *chance*.

But in religion it had a farther force; altars and temples in great numbers were consecrated to this Fortune, as a deity. This intimates, that the heathens had personified, and even deified, their chance; and conceived her as a sort of goddess, who disposed of the fate of men at her pleasure. Hence that invocation of Horace, *O diva, gratum quæ regis Antium*, in the 35th ode of the first book, where he recommends Augustus, then preparing for a visit to Britain, to her protection. From these different sentiments it may be inferred, that the ancients at one time took Fortune for a peremptory cause, bent upon doing good to some, Fortune, Forty. some, and persecuting others; and sometimes for a blind inconstant cause, without any view or determination at all.

If then the word *fortune* had no certain idea in the mouth of those who erected altars to her, much less can it be ascertained what it denotes in the minds of those who now use the word in their writings. They who would substitute the name *Providence* in lieu of that of *Fortune*, cannot give any tolerable sense to half the phrases wherein the word occurs.

Horace paints the goddess, preceded by Necessity, holding nails and wedges in her hands, with a cramp-iron, and melted lead to fasten it; rarely accompanied with Fidelity, unless when she abandons a family; for in that case Fidelity never fails to depart with her, as well as friends.

She is disrespectfully spoken of by most of the Roman writers, and represented as blind, inconstant, unjust, and delighting in mischief, (*Ovid. ad Liv.* ver. 52, ver. 374. (*Hor.* lib. i. od. 34. ver. 26. lib. iii. od. 29. ver. 15. *Statius*, Theb. xii. ver. 505.). However they had a good as well as a bad Fortune, a constant and inconstant Fortune; the latter of which was represented with wings, and a wheel by her, (*Hor.* lib. iii. od. 29. ver. 56.). Juvenal alludes to a statue of Fortune, which exhibited her under a very good character, as the patroness of the poor infants that were exposed by their parents in the streets, (*Sat.* vi. ver. 605.).

The painters represent her in a woman's habit, with a bandage before her eyes, to show that she acts without discernment; and standing on a wheel, to express her instability. The Romans, says Lactantius, represented her with a cornucopia, and the helm of a ship, to shew that she distributes riches, and directs the affairs of the world. In effect, it is with such characters that we see her represented on so many medals, with the inscription, FORTUNA AVG. FORTUNA REDVX, FORTVNÆ AVG. or REDVCIS, &c. Sometimes she is seen pointing at a globe before her feet, with a sceptre in one hand, and holding the cornucopia in the other.

The Romans had a virile as well as a muliebrian Fortune, for the objects of their adoration: the *Fortuna virilis* was honoured by the men, and the *Fortuna muliebris* by the women. They honoured fortune also under a variety of other appellations.

The Romans derived the worship of Fortune from the Greeks, under the reign of Servius Tullius, who dedicated the first temple to her in the public market. Nero also built a temple to Fortune. The Fortune worshipped at Antium was probably of the most exalted character of any among the Romans; if we may judge by the account which Horace gives us of the great solemn processions that were made to her, (*Hor.* lib. 1. od. 35. ver. 22.). But the most celebrated temple of Fortune was at Præneste. Statius speaks of several Fortunes there, and calls them the *Prænestinæ sorores*, (lib. i. Sylv. iii. ver. 80.).

FORTUNE-Tellers. Persons pretending to tell fortunes are to be punished with a year's imprisonment, and standing four times on the pillory. Stat. ix. Geo. II. c. 5.

FORTY DAYS *Court*, the conrt of *attachment* or *woodmote*, held before the verderors of the forest once every forty days, to inquire concerning all offenders against vert and venison. See ATTACHMENT.

Forum. FORUM, in Roman antiquity, a public standing place within the city of Rome, where causes were judicially tried, and orations delivered to the people.

FORUM was also used for a place of traffic, answering to our market-place. These were generally called *fora venalia;* in contradistinction to the former, which were called *fora civilia.*

The *fora civilia* were public courts of justice, very magnificent in themselves, and surrounded with porticoes and stately edifices; of these there were six very remarkable: 1. *Forum Romanum.* 2. *Julianum.* 3. *Augustum.* 4. *Palladium.* 5. *Forum Trajani.* 6. *Forum Salustii.* The *Forum Romanum* was the most noted, and is often called simply *Forum*, by way of eminence. Here was the pleading place called *Rostra*, the *Comitium*, the sanctuary of *Saturn*, temple of *Castor*, &c. See ROSTRA, COMITIUM, &c.

The *fora venalia*, or market-places, were very numerous. The chief of them were the *forum boarium* for oxen or beef; *suarium* for swine; *pistorium* for bread; *cupedinarium* for dainties; *olitorium* for garden stuff.

The Grecian Αγοραι, exactly correspond with the Roman *fora*, being places where courts and markets were held. At Athens they had many *fora*, but the chief of them were the *old* and the *new.*

FORUM Indicere, was the act of the prætor appointing the place in Rome where causes were to be tried. *Agere forum* denoted the bringing on causes out of Rome, in a Roman province (Cicero, Suetonius); the same with *agere conventum* (Florus.)

The term *forum* added to a proper name, denoted some town or market borough; as,

FORUM Allieni, a place mentioned only by Tacitus; and, from what he says of it, thought to be *Ferrara*, capital of the duchy of that name in Italy. E. Long. 12. 5. N. Lat. 44. 46.

FORUM Appii (Cicero, Luke); a town of the Volsci, in Latium, on the Via Appia; a little beyond the Tres Tabernæ; set down in the Jerusalem Itinerary as situated near the river Nymphæus: now entirely extinct.

FORUM Cornelii, a town of the Cispadana, built by Sylla: Now *Imola*, a city in Romagna, and territory of the Pope. E. Long. 12. 12. N. Lat. 44. 30.

FORUM Domitii, a town of Gallia Narbonensis; probably built by Domitius Ahenobarbus, who commanded in those parts: Now *Frontignan*, or *Frontigniac*, in Languedoc, near the Mediterranean. E. Long. 3. 30. N. Lat. 43. 30.

FORUM Fulvii, a town of Liguria, surnamed *Valentinum:* from which it is conjectured that it it is now *Valenza*, in the duchy of Milan; which is confirmed by Peutinger's distances. E. Long. 9°. N. Lat. 45°.

FORUM Gallorum, a small town of the Cispadana, on the Via Æmilia, eight miles from Mutina, beyond the river Scultenna. Here Antony defeated Pansa, and was in his turn defeated by Hirtius: Now *Castelfranco*, in the territory of Bologna.—Another *Forum Gallorum*, a town of the Vascones in the Hither Spain: Now *Gurrea*, a small town of Arragon.

FORUM Julium. There are several towns of this name; as a *Forum Julium* of Gallia Narbonensis; or *Forojulium:* Now *Frejus*, or *Frejules*, in Provence, at the

the mouth of the Argens. *Forum Julium Carnorum*, to the north of Aquileia, in the Transpadana: Now *Cividal di Friuli*, formerly *Cividal d'Austria*, in the territory of Venice.

FORUM *Jutuntorum*, a town of the Insubres, in the Transpadana: Now *Crema*, capital of the Cremasco, in the territory of Venice. E. Long. 10. 15. N. Lat. 45. 20.

FORUM *Livii*, a town of the Semnones, in the Cispadana: Now *Forli*, in Romagna. E. Long. 12. 45. N. Lat. 44. 25.

FORUM *Segusianorum*, situated on the east side of the Liger, in Gallia Celtica: now *Feurs*, on the Loire, in the Lyonnois, capital of the territory of Forez. E. Long. 4. 15. N. Lat. 45. 44.

FORUM *Tiberii*, a town of the Pagus Tigurinus, in Belgica, on the left or south side of the Rhine: Now *Kayserstull;* literally the tribunal of Tiberius, which he held there when commander in the Rhetian war.

FORUM *Volcani* (Strabo); the *Campi Phlegræi* of Pliny; a place in Campania encompassed with rocky eminences, near Puteoli, and distant from it two miles towards Naples, emitting smoke, and in some places flame, like a large extensive furnace, and yielding sulphur: Now called *Solfatara*, in the Terra di Lavoro.

FORUM is also used, among casuists, &c. for jurisdiction; thus they say, *In foro legis*, &c.

FOSS, or FOSSE, in *Fortification*, &c. a ditch or moat. The word is French, formed of the Latin participle *fossum*, of the verb *fodio*, " I dig."

Foss, *Fossa*, in *Anatomy*, a kind of cavity in a bone, with a large aperture, but no exit or perforation. When the aperture is very narrow, it is called a *sinus*.

Foss is particularly used for the cavity or denture in the back part of the neck.

FOSSA MAGNA, or NAVICULARIS, is an oblong cavity, forming the inside of the *pudendum muliebre*, and which presents itself upon opening the labia; and in the middle whereof are the *carunculæ myrtiformes*. See ANATOMY.

FOSSA, in our ancient customs, was a ditch full of water, where women committing felony were drowned; as men were hanged: *Nam et ipsi in omnibus tenementis suis omnem ab antiquo legalem habuere justitiam, videlicet ferrum, fossam, furcas, et similia.* In another sense it is taken for a grave, as appears by these old verses:

Hic jacent in fossa Bedæ venerabilis ossa:
Hic est fossatus, qui bis erat hic cathedratus.

Foss Way was anciently one of the four great Roman highways of England: so called, according to Camden, because it was ditched on both sides, which was the Roman method of making highways.

FOSSARII, in antiquity, a kind of officers in the eastern church, whose business was to inter the dead.

Ciaconius relates, that Constantine created 950 fossaries, whom he took out of the divers colleges or companies of tradesmen: he adds, that they were exempted from taxes, services, burdensome offices, &c.

F. Goar, in his notes on the Greek Euchologion, insinuates that the fossarii were established in the times of the apostles; and that the young men, who carried off the body of Ananias, and those persons full of the fear of God who interred St Stephen, were of the number.

St Jerome assures us, that the rank of fossarii held the first place among the clerks; but he is to be understood of those clerks only who had the direction and intendance of the interment of the devout.

FOSSE, the Roman military way in South Britain, begins at Totness, and passes through Exeter, Ivelchester, Shepton Mallet, Bath, Cirencester, Leicester, the Vale of Belvoir, Newark, Lincoln, to Barton upon the Humber, being still visible in several parts, though of 1400 years standing. It had the name from the fosses or ditches made by the sides of it.

FOSSIL, in *Natural History*, denotes, in general, every thing dug out of the earth, whether it be a native thereof, as metals, stones, salts, earths, and other minerals; or extraneous, reposited in the bowels of the earth by some extraordinary means, as earthquakes, the deluge, &c.

Native fossils are substances found in the earth, or on its surface, of a simple structure, exhibiting no appearances of organization; and these are included under the general names of simple and compound, earthy or metallic minerals. See MINERALOGY.

Extraneous fossils are bodies of the vegetable or animal kingdoms accidentally buried in the earth. Of the vegetable kingdom, there are principally three kinds; trees or parts of them, herbaceous plants, and corals: and of the animal kingdom there are four kinds; sea shells, the teeth or bony palates and bones of fishes, complete fishes, and the bones of land animals. See GEOLOGY.

These adventitious or *extraneous* fossils, thus found buried in great abundance in divers parts of the earth, have employed the curiosity of several of our latest naturalists, who have each their several system to account for the surprising appearances of petrified sea fishes, in places far remote from the sea, and on the tops of mountains; shells in the middle of quarries of stone; and of elephants teeth, and bones of divers animals, peculiar to the southern climates, and plants only growing in the east, found fossil in our northern and western parts.

Some will have these shells, &c. to be real stones, and stone plants, formed after the usual manner of other figured stones; of which opinion is the learned Dr Lister.

Another opinion is, that these fossil shells, with all the foreign bodies found within the earth, as bones, trees, plants, &c. were buried therein at the time of the universal deluge; and that, having been penetrated either by the bituminous matter abounding chiefly in watery places, or by the salts of the earth, they have been preserved entire, and sometimes petrified.

Others think, that those shells, found at the tops of the highest mountains, could never have been carried thither by the waters, even of the deluge; inasmuch as most of these aquatic animals, on account of the weight of their shells, always remain at the bottom of the water, and never move but close along the ground. They imagine, that a year's continuance of the waters of the deluge, intermixed with the salt waters of the sea, upon the surface of the earth, might well give occasion to the production of shells of divers kinds in different climates;

Fossil, Foster.

climates; and that the universal saltness of the water was the real cause of their resemblance to the sea shells, as the lakes formed daily by the retention of rain or spring water produce different kinds.

Others think, that the waters of the sea, and the rivers, with those which fell from heaven, turned the whole surface of the earth upside down; after the same manner as the waters of the Loire, and other rivers, which roll on a sandy bottom, overturn all their sands, and even the earth itself, in their swellings and inundations; and that in this general subversion, the shells came to be interred here, fishes there, trees there, &c. See DELUGE.

Dr Woodward, in his Natural History of the Earth, pursuing and improving the hypothesis of Dr Burnet, maintains the whole mass of earth, with every thing belonging thereto, to have been so broken and dissolved at the time of the deluge, that a new earth was then formed on the bosom of the water, consisting of different strata or beds of terrestrial matter, ranged over each other usually according to the order of their specific gravities. By this means, plants, animals, and especially fishes and shells, not yet dissolved among the rest, remained mixed and blended among the mineral and fossil matters; which preserved them, or at least assumed and retained their figures and impressions either indentedly or in relievo. See GEOLOGY.

Fossil Pitch. See PETROLEUM, MINERALOGY *Index*.

FOSTER, JAMES, a nonconformist divine, very highly celebrated for his pulpit eloquence and erudition, was born at Exeter in the year 1697. At the age of five years he was put to the free school of that city, where his progress in the acquisition of grammar was so rapid, that his master boasted of him as the most eminent genius in his school. From this seminary he went to the academy where young men designed for clergymen in the dissenting interest were educated, where his progress and applause were equally great. His apprehension was remarkably quick, his judgment solid, memory retentive, eloquence commanding, and his talents for argumentation were truly admirable; but above all, his piety was genuine, and few men possessed candour, modesty, liberality, integrity, tenderness and benevolence, in such a remarkable degree. He commenced preacher at the age of 21, and was much admired where he occasionally officiated. About this time the doctrine of the Trinity was much agitated in the west of England, which was not consonant to the notions of Mr Foster, and the honesty and openness of his heart would not allow him to conceal these, which brought so much odium upon him from the orthodox party, that he retired to another scene of action. He became pastor of a congregation at Milborne-port, in Somersetshire; but as soon as his hearers became zealously attached to what was deemed the orthodox opinion, he retired to Ashwick under the hills of Mendip, in the same county. In this asylum he preached to two congregations at a little distance from each other, as poor as they were plain, the united contributions of which did not amount to 15l. per annum. In this humble poverty and obscurity he lived for some years, honourable, however, as it was occasioned by his determined uprightness and sincerity. In the year 1720, he gave the world his "Essay on Fundamentals, with a particular regard to the doctrine of the ever-blessed Trinity," &c. The design of this work was to check an uncharitable and intolerant spirit, at that time extremely prevalent, by shewing that the trinitarian notion is not a fundamental article of Christianity, or made an express condition of salvation in the sacred scriptures. A sermon accompanied this essay, entitled "The resurrection of Christ proved, and vindicated against the most important objections of the ancient Jews, or modern Deists, and his disciples shown to be sufficient witnesses of the fact." From Ashwick he removed to Trowbridge in Wiltshire, where his congregation did not usually exceed 20 or 30 people.

Foster.

By reading Dr Gale's treatise on infant baptism, he became a convert to the doctrine, that immersion is the true scriptural rite, and was accordingly soon after baptised in London in conformity to that mode. This unreserved manner of adopting whatever his conscience believed to be truth, excluded him from almost every religious party among whom he might otherwise have expected preferment. But while he deliberated with himself whether he should abandon the ministry, and acquire the knowledge of some mechanical employment, Robert Houlston, Esq. took him to his house in the capacity of chaplain, where his circle of acquaintances became wider and more respectable. In 1724, he was appointed to succeed Dr Gale in the baptist congregation in Barbican, London. In the year 1728 he commenced a Sunday evening lecture in the Old Jewry, which he continued till within a short time of his death, with such a degree of popularity as few dissenters at that time experienced. In 1732 appeared his valuable work, entitled "The usefulness, truth, and excellency of the Christian revelation, defended against the objections contained in a late book, called Christianity as old as the Creation," &c. In this reply Mr Foster exhibited no ordinary share of talents and ingenuity, and it was admired by the candid and judicious of every description. Dr Tindal, against whom it was written, is said to have spoken of it always with great respect. He published a volume of sermons in the year 1734, followed by other three volumes, the last of which appeared in 1744. At this time he was appointed successor to Dr Jeremiah Hunt, in the protestant congregation at Pinner's-hall. In 1746, he attended the earl of Kilmarnock when under sentence of death for high-treason, after which he published an octavo pamphlet, with the title of "An account of the behaviour of the late earl of Kilmarnock after his sentence, and on the day of his execution."

He received from the Marischal college of Aberdeen the degree of doctor in divinity, accompanied with handsome letters from the principal and Professor Fordyce, the latter of whom thus addressed him. "We beg that you will be so good as to accept of the diploma, as a small mark of the sincere veneration we have for you, and of the sense we entertain of the eminent services you have done to the cause of liberty, religion, and virtue, by your writings as well as public instructions." The first volume in quarto of his 'Discourses on all the Principal Branches of Natural Religion and Social Virtue,' was published in the year 1749, and the second appeared in 1752. They were published by subscription; and to evince the high estimation in which

his

his talents and virtues were held, 2000 names were contained in the list, many of them distinguished by their dignified rank and literary abilities.

In the month of April 1750, he was seized with a violent distemper, from the effects of which he never thoroughly recovered; yet while at all able to officiate, he continued to preach till the beginning of 1752, when he had another attack, which seems to have been of a paralytic nature. After declining for some time, he expired like a genuine Christian on the 5th of November, in the 55th year of his age. His private and public life were alike irreproachable. Such was the wonderful extent of his beneficence, that he must have died in indigent circumstances, had it not been for the numerous subscriptions to his discourses on natural religion. Mr Rider gives him the following eulogium. "His voice was naturally sweet, strong, distinct, harmonious, always adapted to his matter, always varied as his method changed; as expressive of the sense as the most judicious recitative. Monotony was a fault he was never guilty of. His action, the soul of eloquence, was grave, expressive, free from distortions, animated without being theatrical; in short, such as became the pulpit. He reminded us of Paul at Athens, arresting the attention of his auditors." It was no doubt such rare accomplishments which induced Mr Pope to be an occasional hearer, and to pay him the following compliment:

> Let modest Foster, if he will, excel
> Ten metropolitans in preaching well.

In a poem describing the respective merits of dissenting ministers at that period, and supposed to have been the work of Mr Savage, we find the following lines upon Dr Foster.

> But see th' accomplish'd orator appear,
> Refin'd his language, and his reasoning clear;
> Thou only, Foster, hast the pleasing art,
> At once to charm the ear and mend the heart.

Besides the works formerly taken notice of, Dr Foster published three funeral sermons, one of which was intended for that celebrated confessor Mr Emyln; together with a number of essays in the Old Whig.

FOSTER, *Samuel*, an ingenious English mathematician of the last century, and astronomical professor in Gresham college, was one of that learned association which met for cultivating the new philosophy during the political confusions, and which Charles II. established into the Royal Society. Mr Foster, however, died in 1652, before this incorporation took place; but wrote a number of mathematical and astronomical treatises, too many to particularize. There were two other mathematical students of this name; William Foster, a disciple of Mr Oughtred, who taught in London, and Mark Foster, author of a treatise on trigonometry, who lived later than the former two.

FOTHER, or FODDER, is a weight of lead, containing eight pigs, and every pig one and twenty stone and a half; so that it is about a ton or common cart load. Among the plumbers in London, it is nineteen hundred and a half; and at the mines it is two and twenty hundred and a half. The word is of Teutonic origin, from *fuder*.

FOTHERGILL, DR GEORGE, was born in Westmorland in 1705, where his family had been long seated on a competent estate that had descended regularly for several generations. After an academical education in Queen's college, Oxford, of which he became a fellow, he was, in 1751, elected principal of St Edmund's hall, and presented to the vicarage of Brumley in Hampshire. Having been long afflicted with an asthma, he died in 1760. He was the author of a collection of much esteemed sermons, in 2 vols. 8vo. The first volume consists of occasional discourses, published by himself; the second printed from his MSS.

FOTHERGILL, *Dr John*, a late eminent physician, son of John and Margaret, Quakers, was born in 1712, at Carr End in Yorkshire, where his father, who had been a brewer at Knaresborough (after having travelled from one end of America to the other), lived retired on a small estate which he cultivated. The Doctor was the second of five children (four sons and a daughter), and received his education under the care of his grandfather Thomas Hough, a person of fortune in Cheshire, which gave him a predilection for that county), and at Sedbergh in Yorkshire. He afterwards served his time to one Mr Bartlett an apothecary at Bradford. From thence he removed to London, and became a pupil of Dr (afterwards Sir Edward) Wilmot, at St Thomas's hospital. He then went to the university of Edinburgh to study physic, and took his doctor's degree there. From Edinburgh he went to Leyden; whence, after a short stay, he returned to London, and began to practise about the year 1740, in a house in White-hart Court, Lombard-street, where he resided during the greatest part of his life, and acquired most of his fortune. In 1746, he was admitted a licentiate of the College of Physicians in London; and in 1754 a fellow of that of Edinburgh, to which he was a considerable benefactor. He afterwards became a member of the Royal Medical Society at Paris, and a member both of the Royal and Antiquarian Societies. He continued his practice with uninterrupted success till within the last two years of his life, when the illness which he had brought on himself by unremitted attention, obliged him to give up a considerable part of it. Besides his application to medical science, he had imbibed an early taste for natural history, improved by his friend Peter Collinson, and employed himself on conchology and smaller objects of botany. He was for many years a valuable contributor to the Gentleman's Magazine; where his observations on the weather and diseases were begun in April 1751, and discontinued in the beginning of 1756, being disappointed in his views of exciting other experienced physicians in different parts to imitate the example. He had very extensive practice, but he did not add to his art any great or various improvements. His pamphlet on the ulcerous sore throat is, on every account, the best of his publications; but owes much of its merit to the information of the late Dr Letherland. It was printed in 1748, on the re-appearance of that fatal disorder which in 1739 had carried off the two only sons of Mr Pelham. In 1762 Dr Fothergill purchased an estate at Upton in Essex; and formed a botanic garden there, the second in Europe; Kew is the first. In 1766 he began regularly to withdraw, from Midsummer to Michaelmas, from the excessive fatigue of his profession, to Lee Hall, near Middlewich, in Cheshire; which, though he only rented

Fothergill. ed it by the year, he had spared no expence to improve. He took no fees during this recess, but attended to prescribe gratis at an inn in Middlewich once a week. In 1767, after he found himself obliged to relax his attention to business, he removed from his house in the city, to reside in Harpur-street, Red-Lion Square. Some time before his death he had been industrious to contrive a method of generating and preserving ice in the West Indies. He was the patron of Sidney Parkinson, and drew up the preface prefixed to his account of the voyage to the South Seas. At his expence also was made and printed an entire new translation of the whole Bible, from the Hebrew and Greek originals, by Anthony Purver, a Quaker, in two volumes, 1764, folio, and also, in 1780, an edition of Bishop Percy's "Key to the New Testament," adapted to the use of a seminary of young Quakers, at Acworth, near Leeds in Yorkshire, founded in 1778 by the Society, who purchased, by a subscription in which Dr Fothergill stood foremost, the house and an estate of thirty acres which the Foundling Hospital held there, but which they found inconvenient for their purpose on account of distance. The Doctor himself first projected this on the plan of a smaller institution of the same kind at Gildersomes. He also endowed it handsomely by his will. It now contains above 300 children of both sexes, who are clothed and instructed. Among the other beneficent schemes suggested by Dr Fothergill were those of bringing fish to London by land carriage, which, though it did not in every respect succeed, tended to destroy a supposed combination; and of rendering bread much cheaper, though equally wholesome, to the poor, by making it with one part of potatoes and three parts of household flour. But his public benefactions, his encouragements of science, the instances of his attention to the health, the police, the convenience of the metropolis, &c. we cannot pretend to specify. The fortune which Dr Fothergill had acquired was immense; and, taking all things together, the house and moveables in Harpur-street, the property in Essex, and the estate in Cheshire (which he held on a lease), and his ready money, amounted to 80,000l. His business, when he was in full practice, was calculated at near 7000l. per annum. In the influenza of 1775 and 1776, he is said to have had 60 patients on his list daily, and his profit was estimated at 8000l. per annum.

The disorder which hastened his death was a scirrhus of the prostata, and an obstruction of the bladder (in which were found after his death two quarts of water), which had been gradually coming on him for six years past, occasioned by a delicacy, which made him unwilling to alight from his carriage, and when, after his temporary recovery from it the year before he died, he submitted to use relief in his carriage, it was too late. He died at his house in Harpur-street, December 26. 1780; and his remains were interred, January 5. in the Quakers burying-ground at Winchmore-hill, whither they were accompanied by more than 70 coaches and post-chaises, notwithstanding the intention of the executors to have the funeral private. The Doctor by his will appointed, that his shells and other pieces of natural history should be offered to the late Dr Hunter at 500l. under the valuation he ordered to be taken of them. Accordingly Dr Hunter bought them for 1200l. The drawings and collections in natural history were also to be offered to Mr (now Sir Joseph) Bankes at a valuation. His English portraits and prints, which had been collected by Mr John Nickolls of Ware, and purchased by him for 80 guineas, were bought for 200 guineas by Mr Thane. His books were sold by auction, April 30. 1781, and the eight following days. His house and garden at Upton, in which 15 men were constantly employed, were valued at 10,000l. He spared no expence to augment this as well as his other collections. He had an ingenious artist qualified to collect for him at the Cape of Good Hope, and another on the Alps, and employed for several years before his death a painter in natural history at Leeds.

Fothergill || Fotheringay.

Dr Fothergill's character was excellent. A transaction, indeed, with regard to one Dr Leeds, gave occasion to some of his enemies to blame him; but how unjustly, has been abundantly shown by his biographers Dr Elliot and Dr Lettsome. Besides the pamphlet already mentioned, Dr Fothergill wrote a considerable number of Tracts, which are now collected into one volume 8vo, by Dr Elliot. He sometimes wrote in the newspapers, and is said to be the author of more than 100 letters in the Gazetteer, concerning the New Pavement.

FOTHERGILLA, a genus of plants belonging to the polyandria class. See BOTANY *Index*.

FOTHERING, a peculiar method of endeavouring to stop a leak in the bottom of a ship while she is afloat, either under sail or at anchor. It is usually performed in the following manner: A basket is filled with ashes, cinders, and chopped rope yarns, and loosely covered with a piece of canvas; to this is fastened a long pole, by which it is plunged repeatedly in the water, as close as possible to the place where the leak is conjectured to lie. The oakum or chopped rope yarns being thus gradually shaken through the twigs, or over the top of the basket, are frequently sucked into the hole along with the water, so that the leak becomes immediately choked; and the future entrance of the water is thereby prevented.

FOTHERINGAY, a town of Northamptonshire, about four miles from Staneford, situated on the river Avon, or Nen, and consisting of one street. Edward duke of York, in the reign of Henry V. founded and endowed a fine collegiate church here, in which he was interred. At the dissolution, the college and the choir were pulled down, and the bodies of the founder and his family left exposed till Queen Elizabeth's time, who ordered them to be interred, and the present monuments to be erected. On the north side of the church is a free school, founded by Henry VII. or Edward VI. endowed with 20l. per annum for a master, payable out of the exchequer by the receiver of the county. The bridge over the river here was first built by Queen Elizabeth, 1573, of timber, with three pillars upon the foundation. Daniel, first earl of Nottingham, and the other trustees for William Saville, marquis of Halifax, rebuilt it in 1722, of freestone from King's Cliffe. On the south-east side of the cliffe stood the castle; which was of great antiquity and considerable strength. Mary queen of Scots, who had been in the custody of Sir

Amias

Amias Powlet here, was tried and beheaded in the hall; and her son afterwards, forgiving and even taking into favour her greatest enemy Cecil, only took the childish revenge of beating down the castle; which he so completely demolished, that no more than the earthworks now remain. Within the first work is a farm-house, with some carved stones wrought into it, and at the south-west corner of the inner trench are some masses of stone walls. Sir Robert Cotton carried the wainscot of the hall to Connington.

FOU-TCHEOU, a city of China, in the province of FO-KIEN. It carries on a considerable trade; but is chiefly remarkable for the magnificence of its principal bridge, which has more than 100 arches constructed of white stone, and ornamented with a double balustrade throughout. This city is the residence of a viceroy, and has under its jurisdiction nine cities of the third class.

FOUGADE, or FOUGASSE, in the art of war, a little mine, about 8 or 10 feet wide, and 10 or 12 deep, dug under some work or post, which is in danger of falling into the enemy's hands; and charged with sacks of powder, covered with stones, earth, and whatever else can make great destruction. It is set on fire like other mines, with a saucisse. See mine.

FOUL, or FOULE, in the sea language, is used when a ship has been long untrimmed, so that the grass weeds, or barnacles, grow on her sides under water. A rope is also foul when it is either tangled in itself, or hindered by another, so that it cannot run or be overhauled.

FOUL imports, also, the running of one ship against another. This happens sometimes by the violence of the wind, and sometimes by the carelessness of the people on board, to ships in the same convoy, and to ships in port by means of others coming in. The damages occasioned by running foul, are of the nature of those in which both parties must bear a share. They are usually made half to fall upon the sufferer, and half upon the vessel which did the injury; but in cases where it is evidently the fault of the master of the vessel, he is alone to bear the damage.

FOUL-Water. A ship is said to make foul water, when, being under sail, she comes into such shoal water, that though her keel do not touch the ground, yet it comes so near it, that the motion of the water under her raises the mud from the bottom.

FOUL is also a disease in cattle, proceeding from blood, and a waterish rheum that falls down into the legs, and makes them swell.

FOUL or *Pimpled Face.* See *GUTTA Rosacea.*

FOULA, or *FOUL Island*, one of the Shetland isles, lying between six and seven leagues west from the main land. It is about three miles long, narrow, and full of rough, steep, and bare rocks; one of which is so large, and runs up to such a height, that it may be clearly seen from Orkney. This, it is probable, is the Thule of Tacitus. It has scarcely any pasturage, and but little arable land. The only commodities exported are stock fish, train oil, and feathers.

FOULAHS, a people of Africa, which inhabit the confines of the great desert Sahara. The principal of the Foulah states is that within Sierra Leona, and of which Teembo is the capital. See SIERRA LEONA.

FOUMART, a species of MUSTELA. See MAMMALIA *Index.*

FOUNDATION, in *Architecture*, is that part of a building which is under ground. See ARCHITECTURE, N° 104.

Palladio allows a sixth part of the height of the whole building for the hollowing or under-digging; unless there be cellars under ground, in which case he would have it somewhat lower.

FOUNDATION, denotes also a donation or legacy, either in money or lands, for the maintenance and support of some community, hospital, school, &c.

The king only can found a college, but there may be a college in reputation founded by others. If it cannot appear by inquisition who it was that founded a church or college, it shall be intended that it was the king, who has power to found a new church, &c. The king may found and erect an hospital, and give a name to the house upon the inheritance of another, or license another person to do it upon his own lands; and the words *fundo*, *creo*, &c. are not necessary in every foundation, either of a college or hospital, made by the king; but it is sufficient if there be words equivalent: the incorporation of a college or hospital is the very foundation; but he who endows it with lands is the founder; and to the erection of an hospital, nothing more is requisite but the incorporation and foundation. Persons seised of estates in fee simple, may erect and found hospitals for the poor by deed enrolled in chancery, &c. which shall be incorporated, and subject to such visitors as the founder shall appoint, &c. stat. 39 Eliz. c. 5. *Jacob's Law Dict.*

FOUNDER, in a general sense, the person who lays a foundation, or endows a church, school, religious house, or other charitable institution. See FOUNDATION.

FOUNDER, also implies an artist who casts metals, in various forms, for different uses, as guns, bells, statues, printing characters, candlesticks, buckles, &c. whence they are denominated gun-founders, bell-founders, figure-founders, letter-founders, founders of small works, &c. See FOUNDERY.

FOUNDER, in the sea language: A ship is said to founder, when by an extraordinary leak, or by a great sea breaking in upon her, she is so filled with water, that she cannot be freed of it; so that she can neither veer nor steer, but lie like a log; and not being able to swim long, will at last sink.

FOUNDERED, applied to horses. See FARRIERY *Index.*

FOUNDERY, or FOUNDRY, the art of casting all sorts of metals into different forms. It likewise signifies the workhouse or smelting hut wherein these operations are performed.

FOUNDERY of Small Works, or casting in Sand. The sand used for casting small works is at first of a pretty soft, yellowish, and clammy nature; but it being necessary to strew charcoal dust in the mould, it at length becomes of a quite black colour. The sand is worked over and over, on a board, with a roller, and a sort of knife; being placed over a trough to receive it, after it is by these means sufficiently prepared.

This done, they take a wooden board of a length, and breadth proportional to the things to be cast, and putting a ledge round it they fill it with sand, a little moistened, Foundery. moistened, to make it duly cohere. Then they take either wood or metal models of what they intend to cast, and apply them so to the mould, and press them into the sand, as to leave their impression there. Along the middle of the mould is laid half a small brass cylinder, as the chief canal for the metal to run through, when melted, into the models or patterns; and from this chief canal are placed several others, which extend to each model or pattern placed in the frame. After this frame is finished, they take out the patterns, by first loosening them all around, that the sand may not give way.

Then they proceed to work the other half of the mould with the same patterns in just such another frame; only that it has pins, which, entering into holes that correspond to it in the other, make the two cavities of the pattern fall exactly on each other.

The frame, thus moulded, is carried to the melter; who, after extending the chief canal of the counterpart, and adding the cross canals to the several models in both, and strewing mill dust over them, dries them in a kind of oven for that purpose.

Both parts of the mould being dry, they are joined together by means of the pins: and to prevent them giving way, by reason of the melted metal passing through the chief cylindrical canal, they are screwed or wedged up like a kind of press.

While the moulds are thus preparing, the metal is fusing in a crucible of a size proportionate to the quantity of metal intended to be cast.

When the moulds are coolish, the frames are unscrewed or unwedged, and the cast work taken out of the sand, which sand is worked over again for other casting.

Foundery of Statues. The casting of statues depends on the due preparation of the pit, the core, the wax, the outer mould, the inferior furnace to melt off the wax, and the upper to fuse the metal. The pit is a hole dug in a dry place something deeper than the intended figure, and made according to the prominence of certain parts thereof. The inside of the pit is commonly lined with stone or brick; or when the figure is very large, they sometimes work on the ground, and raise a proper fence to resist the impulsion of the melted metal.

The inner mould, or core, is a rude mass to which is given the intended attitude and contours. It is raised on an iron grate, strong enough to sustain it, and is strengthened within by several bars of iron. It is generally made either of potters clay, mixed with hair and horse dung; or of plaster of Paris mixed with brick dust. The use of the core is to support the wax, the shell, and lessen the weight of the metal. The iron bars and the core are taken out of the brass figure through an aperture left in it for that purpose, which is soldered up afterwards. It is necessary to leave some of the iron bars of the core, that contribute to the steadiness of the projecting part, within the brass figure.

The wax is a representation of the intended statue. If it be a piece of sculpture, the wax should be all of the sculptor's own hand, who usually forms it on the core: Though it may be wrought separately in cavities, moulded on a model, and afterwards arranged on the ribs of iron over the grate; filling the vacant space in the middle with liquid plaster and brick dust, whereby the inner core is proportioned as the sculptor carries on the wax.

When the wax, which is the intended thickness of the metal, is finished, they fill small waxen tubes perpendicular to it from top to bottom, to serve both as canals for the conveyance of the metal to all parts of the work; and as vent holes, to give passage to the air, which would otherwise occasion great disorder when the hot metal came to encompass it.

The work being brought thus far, must be covered with its shell, which is a kind of crust laid over the wax, and which being of a soft matter, easily receives the impression of every part, which is afterwards communicated to the metal upon its taking the place of the wax, between the shell and the mould. The matter of this outer mould is varied according as different layers are applied. The first is generally a composition of clay, and old white crucibles well ground and sifted, and mixed up with water to the consistence of a colour fit for painting: accordingly they apply it with a pencil, laying it seven or eight times over, and letting it dry between whiles. For the second impression they add horse dung and natural earth to the former composition. The third impression is only horse dung and earth. Lastly, The shell is finished by laying on several more impressions of this last matter, made very thick with the hand.

The shell, thus finished, is secured by several iron girths, bound round it, at about half a foot distance from each other, and fastened at the bottom to the grate under the statue, and at top to a circle of iron where they all terminate.

If the statue be so big that it would not be easy to move the moulds with safety, they must be wrought on the spot where it is to be cast. This is performed two ways: in the first, a square hole is dug under ground, much bigger than the mould to be made therein, and its inside lined with walls of free-stone or brick. At the bottom is made a hole of the same materials, with a kind of furnace, having its aperture outwards: in this is a fire made to dry the mould, and afterwards melt the wax. Over this furnace is placed the grate, and upon this the mould, &c. formed as above. Lastly, At one of the edges of the square pit, is made another large furnace to melt the metal. In the other way, it is sufficient to work the mould above ground, but with the like precaution of a furnace and grate underneath. When finished, four walls are to be run around it, and by the side thereof a massive made for a melting furnace. For the rest, the method is the same in both. The mould being finished, and enclosed as described, whether under ground or above it, a moderate fire is lighted in the furnace under it, and the whole covered with planks, that the wax may melt gently down, and run out at pipes contrived for that purpose, at the foot of the mould, which are afterwards exactly closed with earth, so soon as the wax is carried off. This done, the hole is filled up with bricks thrown in at random, and the fire in the furnace augmented, till such time as both the bricks and mould become red hot. After this, the fire being extinguished, and every thing cold again, they

Foundery. they take out the bricks, and fill up their place with earth moistened, and a little beaten at the top of the mould, in order to make it the more firm and steady. These preparatory measures being duly taken, there remains nothing but to melt the metal, and run it into the mould. This is the office of the furnace above described, which is commonly made in the form of an oven with three apertures, one to put in the wood, another for a vent, and a third to run the metal out at. From this last aperture, which is kept very close while the metal is in fusion, a small tube is laid, whereby the melted metal is conveyed into a large earthen bason, over the mould, into the bottom of which all the big branches of the jets, or casts, which are to convey the metal into all the parts of the mould, are inserted.

These casts or jets are all terminated with a kind of plugs, which are kept close, that, upon opening the furnace, the brass, which gushes out with violence, may not enter any of them, till the bason be full enough of matter to run into them all at once. Upon which occasion they pull out the plugs, which are long iron rods with a head at one end, capable of filling the whole diameter of each tube. The whole of the furnace is opened with a long piece of iron fitted at the end of each pole, and the mould filled in an instant. This completes the work in relation to the casting part; the rest being the sculptor's or carver's business, who, taking the figure out of the mould and earth wherewith it is encompassed, saws off the jets with which it appears covered over, and repairs it with chissels, gravers, puncheons, &c.

Foundery of Bells. The metal, it is to be observed, is different for bells from what it is for statues; there being no tin in the statue metal; but there is a fifth, and sometimes more, in the bell metal.

The dimensions of the core and the wax, for bells, if a chime of bells especially, are not left to chance, but must be measured on a scale, or diapason, which gives the height, aperture, and thickness, necessary for the several tones required.

It is on the wax that the several mouldings and other ornaments and inscriptions, to be represented in relievo on the outside of the bell, are formed. The clapper or tongue is not properly part of the bell, but is furnished from other hands. In Europe, it is usually of iron, with a large knob at the extreme; and is suspended in the middle of the bell. In China, it is only a huge wooden mallet, struck by force of arm against the bell; whence they can have but little of that consonancy so much admired in some of our chimes of bells. The Chinese have an extraordinary way of increasing the sound of their bells, viz. by leaving a hole under the cannon; which our bell-founders would reckon a defect.

The proportions of our bells differ very much from those of the Chinese. In ours, the modern proportions are, to make the diameter 15 times the thickness of the brim, and the height 12 times. The parts of a bell are, 1. The sounding bow, terminated by an inferior circle, which grows thinner and thinner. 2. The brim or that part of a bell whereon the clapper strikes, and which is thicker than the rest. 3. The outward sinking of the middle of the bell, or the point under which it grows wider to the brim. 4. The waist or furniture, and the part that grows wider and thicker quite to the brim. 5. The upper vase, or that part which is above the waist. 6. The pallet which supports the staple of the clapper within. 7. The bent and hollowed branches of metal uniting with the cannons, to receive the iron keys, whereby the bell is hung up to the beam, which is its support and counterpoise when rung out.

The business of bell foundery is reducible to three particulars. 1. The proportion of a bell. 2. The forming of the mould. And, 3. The melting of the metal. There are two kinds of proportions, viz. the simple and the relative; the former are those proportions only that are between the several parts of a bell to render it sonorous; the relative proportions establish a requisite harmony between several bells.

The method of forming the profile of a bell, previous to its being cast, in which the proportion of the several parts may be seen, is as follows: the thickness of the brim, C 1 (Plate CCXXIII.) is the foundation of every other measure, and is divided into three equal parts. First, draw the line HD, which represents the diameter of the bell; bisect it in F, and erect the perpendicular F*f*; let DF and HF be also bisected in E and G, and two other perpendiculars E *e*, G *a*, be erected at E and G: GE will be the diameter of the top or upper vase, i. e. the diameter of the top will be half that of the bell; and it will, therefore, be the diameter of a bell which will sound an octave to the other. Divide the diameter of the bell or the line HD into 15 equal parts, and one of these will give C 1 the thickness of the brim; divide again each of these 15 equal parts into three other equal parts, and then form a scale. From this scale take 12 of the larger divisions or $\frac{2}{15}$ of the whole scale in the compass, and setting one leg in D describe an arc to cut the line E *e* in N; draw ND, and divide this line into 12 equal parts; at the point 1 erect the perpendicular 1 C=10, and C 1 will be the thickness of the brim $=\frac{1}{15}$ of the diameter: draw the line CD; bisect DN; and at the point of bisection erect the perpendicular 6 K=$1\frac{1}{2}$ of the larger divisions on the scale. With an opening of the compass equal to twice the length of the scale or 30 brims, setting one leg in N, describe an arc of a circle, and with the same leg in K and the same opening describe another arc to intersect the former: on this point of intersection as a centre, and with a radius equal to 30 brims, describe the arc NK; in 6 K produced take KB=$\frac{1}{3}$ of the larger measure of the scale or $\frac{1}{3}$ of the brim, and on the same centre with the radius $30\frac{1}{3}$ brims describe an arc AB parallel to NK. For the arc BC, take 12 divisions of the scale or 12 brims in the compass; find a centre, and from that centre, with this opening, describe the arc BC, in the same manner as NK or AB were described. There are various ways of describing the arc K *p*; some describe it on a centre at the distance of nine brims from the points *p* and K; others, as it is done in the figure, on a centre at the distance only of seven brims from those points. But it is necessary first to find the point *p*, and to determine the rounding of the

Plate CCXXIII.

Foundery. the bell p 1. For this purpose, on the point C as a centre, and with the radius C 1, describe the arc 1 p n; bisect the part 1, 2 of the line D n, and erecting the perpendicular p m, this perpendicular will cut the arc 1 p n in m, which terminates the rounding 1 p. Some founders make the bendings K a third of a brim lower than the middle of the line DN; others make the part C 1 D more acute, and instead of making C 1 perpendicular to DN at 1, draw it $\frac{1}{8}$th of a brim higher, making it still equal to one brim; so that the line 1 D is longer than the brim C 1. In order to trace out the top part N a, take in the compass eight divisions of the scale or eight brims, and on the points N and D as centres, describe arcs to intersect each other in 8: on this point 8, with a radius of eight brims, describe the arc N b; this arc will be the exterior curve of the top or crown: on the same point 8 as a centre, and with a radius equal to $7\frac{2}{3}$ brims, describe the arc A e, and this will be the interior curve of the crown, and its whole thickness will be one-third of the brim. As the point 8 does not fall in the axis of the bell, a centre M may be found in the axis, by describing, with the interval of eight brims on the centres D and H, arcs which will intersect in M; and this point may be made the centre of the inner and outer curves of the crown as before. The thickness of the cap which strengthens the crown at Q is about one-third of the thickness of the brim; and the hollow branches or ears about one-sixth of the diameter of the bell. The height of the bell in proportion to its diameter as 12 to 15, or in the proportion of the fundamental sound to its third major: whence it follows, that the sound of a bell is principally composed of the sound of its extremity or brim as a fundamental, of the sound of the crown which is an octave to it, and of that of the height which is a third.

The particulars necessary for making the mould of a bell are, 1. The earth: the most cohesive is the best; it must be well ground and sifted, to prevent any chinks. 2. Brick stone; which must be used for the mine, mould, or core, and for the furnace. 3. Horse dung, hair, and hemp, mixed with the earth, to render the cement more binding. 4. The wax for inscriptions, coats of arms, &c. 5. The tallow equally mixed with the wax, in order to put a slight lay of it upon the outer mould, before any letters are applied to it. 6. The coals to dry the mould.

For making the mould, they have a scaffold consisting of four boards ranged upon tressels. Upon this they carry the earth, grossly diluted, to mix it with horse dung, beating the whole with a large spatula.

The compasses of construction is the chief instrument for making the mould, which consist of two different legs joined by a third piece. And last of all the founders shelves, on which are the engravings of the letters, cartridges, coats of arms, &c.

They first dig a hole of a sufficient depth to contain the mould of the bell, together with the case or cannon, under ground; and about six inches lower than the terreplain, where the work is performed. The hole must be wide enough for a free passage between the mould and walls of the hole, or between one mould and another, when several bells are to be cast. At the centre of the hole is a stake erected, that is strongly fastened in the ground. This supports an iron peg, on which the pivot of the second branch of the compasses turns. The stake is encompassed with a solid brick-work, perfectly round, about half a foot high, and of the proposed bell's diameter. This they call a *millstone*. The parts of the moulds are, the core, the model of the bell, and the shell. When the outer surface of the core is formed, they begin to raise the core, which is made of bricks that are laid in courses of equal height upon a lay of plain earth. At the laying of each brick, they bring near it the branch of the compasses on which the curve of the core is shaped, so as that there may remain between it and the curve the distance of a line, to be afterwards filled up with layers of cement. The work is continued to the top, only leaving an opening for the coals to bake the core. This work is covered with a layer of cement, made of earth and horse dung; on which they move the compasses of construction, to make it of an even smoothness everywhere.

The first layer being finished, they put the fire to the core, by filling it half with coals, through an opening that is kept shut, during the baking, with a cake of earth that has been separately baked. The first fire consumes the stake, and the fire is left in the core half, or sometimes a whole day: the first layer being thoroughly dry, they cover it with a second, third, and fourth; each being smoothed by the board of the compasses, and thoroughly dried before they proceed to another.

The core being completed, they take the compasses to pieces, with intent to cut off the thickness of the model, and the compasses are immediately put in their place to begin a second piece of the mould. It consists of a mixture of earth and hair, applied with the hand on the core, in several cakes that close together. This work is finished by several layers of a thinner cement of the same matter, smoothed by the compasses, and thoroughly dried before another is laid on. The first layer of the model is a mixture of wax and grease spread over the whole. After which are applied the inscriptions, coats of arms, &c. besmeared with a pencil dipped in a vessel of wax in a chafing dish: this is done for every letter. Before the shell is begun, the compasses are taken to pieces, to cut off all the wood that fills the place of the thickness to be given to the shell.

The first layer is the same earth with the rest, sifted very fine: while it is tempering in water, it is mixed with cows hair to make it cohere. The whole being a thin cullis, is gently poured on the model, that fills exactly all the sinuosities of the figures, &c. and this is repeated till the whole is two lines thick over the model. When this layer is thoroughly dried, they cover it with a second of the same matter, but somewhat thicker; when this second layer becomes of some consistence, they apply the compasses again, and light a fire in the core, so as to melt off the wax of the inscriptions, &c.

After this, they go on with other layers of the shell, by means of the compasses. Here they add to the cows hair a quantity of hemp, spread upon the layers, and afterwards smoothed by the board of the compasses.

passes. The thickness of the shell comes to four or five inches lower than the millstone before observed, and surrounds it quite close, which prevents the extravasation of the metal. The wax should be taken out before the melting of the metal.

The ear of the bell requires a separate work, which is done during the drying of the several incrustations of the cement. It has seven rings: the seventh is called the *bridge*, and unites the others, being a perpendicular support to strengthen the curves. It has an aperture at the top, to admit a large iron peg, bent at the bottom; and this is introduced into two holes in the beam, fastened with two strong iron keys. There are models made of the rings, with masses of beaten earth, that are dried in the fire in order to have the hollow of them. Those rings are gently pressed upon a layer of earth and cows hair, one half of its depth; and then taken out, without breaking the mould. This operation is repeated 12 times for 12 half moulds, that two and two united may make the hollows of the six rings: the same they do for the hollow of the bridge, and bake them all to unite them together.

Upon the open place left for the coals to be put in are placed the rings that constitute the ear. They first put into this open place the iron ring to support the clapper of the bell; then they make a round cake of clay, to fill up the diameter of the thickness of the core. This cake, after baking, is clapt upon the opening, and soldered with a thin mortar spread over it, which binds the cover close to the core.

The hollow of the model is filled with an earth, sufficiently moist to fix on the place, which is strewed at several times upon the cover of the core; and they beat it gently with a pestle, to a proper height; and a workman smooths the earth at top with a wooden trowel dipped in water.

Upon this cover, to be taken off afterwards, they assemble the hollows of the rings. When every thing is in its proper place, they strengthen the outside of the hollows with mortar, in order to bind them with the bridge, and keep them steady at the bottom, by means of a cake of the same mortar, which fills up the whole aperture of the shell. This they let dry, that it may be removed without breaking. To make room for the metal, they pull off the hollows of the rings, through which the metal is to pass, before it enters into the vacuity of the mould. The shell being unloaded of its ear, they range under the millstone five or six pieces of wood, about two feet long, and thick enough to reach almost the lower part of the shell; between these and the mould, they drive in wooden wedges with a mallet, to shake the shell of the model whereon it rests, so as to be pulled up and got out of the pit.

When this and the wax are removed, they break the model and the layer of earth, through which the metal must run, from the hollow of the rings, between the shell and the core. They smoke the inside of the shell, by burning straw under it, that helps to smooth the surface of the bell. Then they put the shell in the place, so as to leave the same interval between that and the core; and before the hollows of the rings or the cap are put on again, they add two vents, that are united to the rings, and to each other, by a mass of baked cement. After which they put on this mass of the cap, the rings, and the vent, over the shell, and solder it with thin cement, which is dried gradually by covering it with burning coals. Then they fill up the pit with earth, beating it strongly all the time round the mould.

The furnace has a place for the fire, and another for the metal. The fire-place has a large chimney with a spacious ash-hole. The furnace which contains the metal is vaulted, whose bottom is made of earth, rammed down; the rest is built with brick. It has four apertures; the first, through which the flame revibrates; the second is closed with a stopple that is opened for the metal to run; the others are to separate the dross or scoriæ of the metal by wooden rakes: through these last apertures passes the thick smoke. The ground of the furnace is built sloping, for the metal to run down.

Foundery of Great Guns and Mortar Pieces. The method of casting these pieces is little different from that of bells; they are run massy, without any core, being determined by the hollow of the shell; and they are afterwards bored with a steel trepan, that is worked either by horses or a water-mill.

For the metal, parts, proportions, &c. of these pieces, see Gunnery.

Letter Foundery, or *Casting of Printing Letters.* In the business of cutting, casting, &c. letters for printing, the letter-cutter must be provided with a vice, hand-vice, hammers, and files of all sorts for watchmakers use; as also gravers and sculpters of all sorts, and an oil-stone, &c. suitable and sizeable to the several letters to be cut: a flat gage made of box to hold a rod of steel, or the body of a mould, &c. exactly perpendicular to the flat of the using file: a sliding gage, whose use is to measure and set off distances between the shoulder and the tooth, and to mark it off from the end, or from the edge of the work; a face gage, which is a square notch cut with a file into the edge of a thin plate of steel, iron, or brass, of the thickness of a piece of common tin, whose use is to proportion the face of each sort of letter, viz. long letters, ascending letters, and short letters. So there must be three gages; and the gage for the long letters is the length of the whole body supposed to be divided into 42 equal parts. The gage for the ascending letters Roman and Italic are, $\frac{5}{7}$ or 30 parts of 42, and 33 parts for the English face. The gage for the short letters is $\frac{3}{7}$, or 18 parts of 42 of the whole body for the Roman and Italic, and 22 parts for the English face.

The Italic and other standing gages are to measure the scope of the Italic stems, by applying the top and bottom of the gage to the top and bottom lines of the letters, and the other side of the gage to the stem; for when the letter complies with these three sides of the gage, that letter has its true shape.

The next care of the letter cutter is to prepare good steel punches, well tempered, and quite free from all veins of iron; on the face of which he draws or marks the exact shape of the letter with pen and ink if the letter be large, or with a smooth blunted point of a needle if it be small; and then with sizeable and proper shaped and pointed gravers and sculpters, digs or sculps out the steel between the strokes or marks he made on the face of the punch, and leaves the marks standing

standing on the face. Having well shaped the inside strokes of his letter, he deepens the hollows with the same tools; for if a letter be not deep in proportion to its width, it will, when used at press, print black, and be good for nothing. This work is generally regulated by the depth of the counter-punch. Then he works the outside with proper files till it be fit for the matrice.

But before we proceed to the sinking and justifying of the matrices, we must provide a mould to justify them by, of which there is a draught in Plate CCXXIII. fig. 1. 2.

Plate CCXXIII. fig. 1. & 2.

Every mould is composed of an upper and an under part. The under part is delineated in fig. 1. The upper part is marked fig. 2. and is in all respects made like the under part, excepting the stool behind, and the bow or spring also behind: and excepting a small roundish wire between the body and carriage, near the break, where the under part hath a small rounding groove made in the body. This wire, or rather half wire, in the upper part makes the nick in the shank of the letter, when part of it is received into the groove in the under part. These two parts are so exactly fitted and gaged into one another (viz. the male gage marked *c* in fig. 2. into the female marked *g* in fig. 1.), that when the upper part of the mould is properly placed on, and in the upper part of the mould, both together make the entire mould, and may be slid backwards for use so far, till the edge of either of the bodies on the middle of either carriage comes just to the edge of the female gages cut in each carriage; and they may be slid forward so far, till the bodies on either carriage touch each other: and the sliding of these two parts of the mould backwards makes the shank of the letter thicker, because the bodies on each part stand wider asunder; and the sliding them forwards makes the shank of the letter thinner, because the bodies on each part of the mould stand closer together. The parts of the mould are as follow: viz. a, The carriage. b, The body. c, The male gage. d e, The mouth-piece. f i, The register. g, The female gage. h, The hag, *a a a a*, The bottom-plate. *b b b*, The wood on which the bottom-plate lies. *c c c*, The mouth. *d d*, The throat. *e d d*, The pallat. *f*, The nick. *g g*, The stool. *h h*, The spring or bow.

Then the mould must be justified: and first the founder justifies the body, by casting about 20 proofs or samples of letters; which are set up in a composing stick, with all their nicks towards the right hand; and then by comparing these with the pattern letters, set up in the same manner, he finds the exact measure of the body to be cast. He also tries if the two sides of the body are parallel, or that the body be no bigger at the head than at the foot, by taking half the number of his proofs and turning them with their heads to the feet of the other half; and if then the heads and the feet be found exactly even upon each other, and neither to drive out nor get in, the two sides may be pronounced parallel. He farther tries whether the two sides of the thickness of the letter be parallel, by first setting his proofs in the composing stick with their nicks upwards, and then turning one-half with their heads to the feet of the other half; and if the heads and feet lie exactly upon each other, and neither drive out nor get in, the two sides of the thickness are parallel.

The mould thus justified, the next business is to prepare the matrices. A matrice is a piece of brass or copper of about an inch and a half long, and of thickness in proportion to the size of the letter it is to contain. In this metal is sunk the face of the letter intended to be cast, by striking the letter punch about the depth of an n. After this the sides and face of the matrice must be justified and cleared with files of all bunchings made by sinking the punch.

Every thing thus prepared, it is brought to the furnace; which is built of brick upright, with four square sides, and a stone on the top, in which stone is a wide round hole for the pan to stand in. A foundery of any consequence has several of these furnaces in it.

As to the metal of which the types are to be cast, this, in extensive founderies, is always prepared in large quantities; but cast into small bars, of about 20 pounds weight, to be delivered out to the workmen as occasion requires. In the letter foundery which has been long carried on with reputation under the direction of Mess. Wilson and Sons at Glasgow, we are informed, that a stock of metal is made up at two different times of the year, sufficient to serve the casters at the furnace for six months each time. For this purpose, a large furnace is built under a shade, furnished with a wheel vent, in order the more equally to heat the sides of a strong pot of cast iron, which holds when full 15 hundred weight of the metal. The fire being kindled below, the bars of lead are let softly down into the pot, and their fusion promoted by throwing in some pitch and tallow, which soon inflame. An outer chimney, which is built so as to project about a foot over the farthest lip of the pot, catches hold of the flame by a strong draught, and makes it act very powerfully in melting lead; whilst it serves at the same time to convey away all the fumes, &c. from the workmen, to whom this laborious part of the business is committed. When the lead is thoroughly melted, a due proportion of the regulus of antimony and other ingredients are put in, and some more tallow inflamed to make the whole incorporate sooner. The workmen now having mixed the contents of the pot very thoroughly by stirring long with a large iron ladle, next proceed to draw the metal off into the small troughs of cast iron, which are ranged to the number of fourscore upon a level platform, faced with stone, built towards the right hand. In the course of a day 15 hundred weight of metal can be easily prepared in this manner; and the operation is continued for as many days as are necessary to prepare a stock of metal of all the various degrees of hardness. After this, the whole is disposed into presses according to its quality, to be delivered out occasionally to the workmen.

The founder must now be provided with a ladle, which differs nothing from other iron ladles but in its size; and he is provided always with ladles of several sizes, which he uses according to the size of the letters he is to cast. Before the caster begins to cast, he must kindle his fire in the furnace to melt the metal in the pan. Therefore he takes the pan out of the hole in the stone, and there lays in coals and kindles them; and, when they are well kindled, he sets the pan in again,

again, and puts in metal into it to melt; if it be a small-bodied letter he casts, or a thin letter of great bodies, his ladle must be very hot, nay sometimes red hot, to make the letter come. Then having chosen a ladle that will hold about so much as the letter and break is, he lays it at the stoking hole, where the flame bursts out, to heat. Then he ties a thin leather, cut with its narrow end against the face to the leather groove of the matrice, by whipping a brown thread twice about the leather groove, and fastening the thread with a knot. Then he puts both halves of the mould together, and puts the matrice into the matrice-cheek, and places the foot of the matrice on the stool of the mould, and the broad end of the leather upon the wood of the upper half of the mould, but not tight up, lest it might hinder the foot of the matrice from sinking close down upon the stool in a train of work. Then laying a little rosin on the upper wood of the mould, and having his casting ladle hot, he with the boiling side of it melts the rosin: and, when it is yet melted, presses the broad end of the leather hard down on the wood, and so fastens it to the wood; all this is the preparation.

Now he comes to casting. Wherefore, placing the under half of the mould in his left hand, with the hook or hag forward, he clutches the ends of its wood between the lower part of the ball of his thumb and his three hind fingers; then he lays the upper half of the mould upon the under half, so that the male gages may fall into the female gages, and at the same time the foot of the matrice places itself upon the stool; and, clasping his left hand thumb strong over the upper half of the mould, he nimbly catches hold of the bow or spring with his right hand fingers at the top of it, and his thumb under it, and places the point of it against the middle of the notch in the backside of the matrice, pressing it as well forwards towards the mould, as downwards by the shoulder of the notch close upon the stool, while at the same time with his hinder fingers, as aforesaid, he draws the under half of the mould towards the ball of his thumb, and thrusts by the ball of his thumb the upper part towards his fingers, that both the registers of the mould may press against both sides of the matrice, and his thumb and fingers press both halves of the mould close together.

Then he takes the handle of his ladle in his right hand, and with the boll of it gives a stroke, two or three, outwards upon the surface of the melted metal, to scum or clear it from the film or dust that may swim upon it; then takes up the ladle full of metal, and having his mould, as aforesaid, in his left hand, he a little twists the left side of his body from the furnace, and brings the geat of his ladle (full of metal) to the mouth of the mould, and twists the upper part of his right hand towards him to turn the metal into it, while at the same moment of time he jilts the mould in his left hand forwards, to receive the metal with a strong shake (as it is called), not only into the body of the mould, but while the metal is yet hot running, swift and strongly, into the very face of the matrice, to receive its perfect form there, as well as in the shank.

Then he takes the upper half of the mould off the under half, by placing his right hand thumb on the end of the wood next his left hand thumb, and his two middle fingers at the other end of the wood; and finding the letter and break lie in the under half of the mould (as most commonly by reason of its weight it does), he throws or tosses the letter, break and all, upon a sheet of waste paper laid for that purpose on the bench, just a little beyond his left hand, and is then ready to cast another letter as before; and also, the whole number that is to be cast with that matrice. A workman will ordinarily cast about 3000 of these letters in a day.

When the casters at the furnace have got a sufficient number of types upon the tables, a set of boys come and nimbly break away the jets from them: the jets are thrown into the pots, and the types are carried away in parcels to other boys, who pass them swiftly under their fingers, defended by leather, upon smooth flat stones, in order to polish their broadsides. This is a very dexterous operation, and is a remarkable instance of what may be effected by the power of habit and long practice; for these boys, in turning up the other side of the type, do it so quickly by a mere touch of the fingers of the left hand, as not to require the least perceptible intermission in the motion of the right hand upon the stones. The types, thus finely smoothed and flattened on the broad sides, are next carried to another set of boys, who sit at a square table, two on each side, and there are ranged upon long rulers or sticks, fitted with a small projection, to hinder them from sliding off backwards. When these sticks are so filled, they are placed two and two, upon a set of wooden pins fixed into the wall, near the dresser, sometimes to the amount of an hundred, in order to undergo the finishing operations. This workman, who is always the most expert and skilful in all the different branches carried on at the foundery, begins by taking one of these sticks, and, with a peculiar address, slides the whole column of types off upon the dressing-stick: this is made of well-seasoned mahogany, and furnished with two end-pieces of steel, a little lower than the body of the types, one of which is moveable, so as to approach the other by means of a long screw-pin, inserted in the end of the stick. The types are put into the stick with their faces next to the back or projection; and after they are adjusted to one another so as to stand even, they are then bound up, by screwing home the moveable end-piece. It is here where the great and requisite accuracy of the moulds comes to be perceived; for in this case the whole column, so bound up, lies flat and true upon the stick, the two extreme types being quite parallel, and the whole has the appearance of one solid continuous plate of metal. The least inaccuracy in the exact parallelism of the individual type, when multiplied so many times, would render it impossible to bind them up in this manner, by disposing them to rise or spring from the stick by the smallest pressure from the screw. Now, when lying so conveniently with the narrow edges uppermost, which cannot possibly be smoothed in the manner before mentioned by the stones, the workmen does this more effectually by scraping the surface of the column with a thick-edged but sharp razor, which at every stroke brings on a very fine smooth skin, like to polished silver: and thus he proceeds till in about half a minute he comes to the farther end of the stick. The other edges of

Foundery, Fount. of the types are next turned upwards, and polished in the same manner. It is whilst the types thus lie in the dressing-stick that the operation of bearding or barbing is performed, which is effected by running a plane, faced with steel, along the shoulder of the body next to the face, which takes more or less off the corner, as occasion may require. Whilst in the dressing stick, they are also grooved, which is a very material operation. In order to understand this, it must be remembered, that wheu the types are first broken off from the jets, some superfluous metal always remains, which would make them bear very unequally against the paper whilst under the printing press, and effectually mar the impression. That all these inequalities may, therefore, be taken away, and that the bearings of every type may be regulated by the shoulders imparted to them all alike from the mould, the workman or dresser proceeds in the following manner: The types being screwed up in the stick, as before mentioned, with the jet end outermost, and projecting beyond the wood about one-eighth of an inch, the stick is put into an open press, so as to present the jet end uppermost, and then every thing is made fast by driving a long wedge, which bears upon a slip of wood, which lies close to the types the whole length: then a plough or plane is applied, which is so constructed as to embrace the projecting part of the types betwixt its long sides, which are made of polished iron. When the plane is thus applied, the steel cutter bearing upon that part between the shoulders of the types, where the inequalities lie, the dresser dexterously glides it along, and by this means strips off every irregular part that comes in the way, and so makes an uniform groove the whole length, and leaves the two shoulders standing; by which means every type becomes precisely like to another, as to the height against paper. The types being now finished, the stick is taken out of the press, and the whole column replaced upon the other stick; and after the whole are so dressed, he proceeds to pick out the bad letters, previous to putting them up into pages and papers. In doing this he takes the stick into his left hand, and turning the faces near to the light, he examines them carefully, and whenever an imperfect or damaged letter occurs, he nimbly plucks it out with a sharp bodkin, which he holds in the right hand for that purpose. Those letters which, from their form, project over the body of the type, and which cannot on this account be rubbed on the stones, are scraped on the broadsides with a knife or file, and some of the metal next the face pared away with a pen-knife, in order to allow the type to come close to any other. This operation is called *kerning*.

The excellence of printing types consists not only in the due performance of all the operations above described, but also in the hardness of the metal, form, and fine proportion of the character, and in the exact bearing and ranging of the letters in relation to one another.

FOUNT, or Font, among printers, &c. a set or quantity of characters or letters of each kind, cast by a letter-founder, and sorted.—We say, a founder has cast a fount of pica, of english, of pearl, &c. meaning that he has cast a set of characters of these kinds.

A complete fount not only includes the running letters, but also large and small capitals, single letters, double letters, points, commas, lines, and numeral characters.

Fount, Fountain. Founts are large or small, according to the demand of the printer, who orders them by the hundred weight, or by sheets. When the printer orders a fount of 500, he means that the fount should weigh 500lb. When he demands a fount of 10 sheets, it is understood, that with that fount he shall be able to compose 10 sheets, or 20 forms, without being obliged to distribute. The founder takes his measures accordingly; he reckons 120 pounds for a sheet, including the quadrates, &c. or 60 pounds for a form, which is half a sheet: not that the sheet always weighs 120 pounds, or the form 60 pounds; on the contrary, it varies according to the size of the form; besides, it is always supposed that there are letters left in the cases.

The letter-founders have a kind of list, or tariff, whereby they regulate their founts: the occasion thereof is, that some letters being in much more use, and oftener repeated than others, their cells or cases should be better filled and stored than those of the letters which do not return so frequently. Thus the *o* and *i*, for instance, are always in greater quantity than the *k* or *z*.

This difference will be best perceived from a proportional comparison of those letters with themselves, or some others. Suppose a fount, of 100,000 characters, which is a common fount; here the *a* should have 5000, the *c* 3000, the *e* 11,000, the *i* 6000, the *m* 3000, the *k* only 30, and the *x*, *y* and *z*, not many more. But this is only to be understood of the letters of the lower case; those of the upper having other proportions, which it would be, here, too long to insist on.

FOUNTAIN, a spring or source of water rising out of the earth. Among the ancients, fountains were generally esteemed as sacred; but some were held to be so in a more particular manner. The good effects received from cold baths gave springs and rivers this high reputation; for their salutary influence was supposed to proceed from some presiding deity. Particular reasons might occasion some to be held in greater veneration than others. It was customary to throw little pieces of money into those springs, lakes, or rivers, which were esteemed sacred, to render the presiding divinities propitious; as the touch of a naked body was supposed to pollute their hallowed waters. For the phenomena, theory, and origin of fountains or springs, see Spring.

Artificial Fountain, called also a *jet d'eau*, is a contrivance by which water is violently spouted upwards. See Hydrodynamics.

Boiling Fountain. See Iceland.

Fountain-*Tree*, a very extraordinary vegetable growing in one of the Canary islands, and likewise said to exist in some other places, which distils water from its leaves in such plenty as to answer all the purposes of the inhabitants who live near it. Of this tree we have the following account in Glasse's history of the Canary islands.—"There are only three fountains of water in the whole island of Hierro, wherein the fountain-tree grows. One of these fountains is called *Acof*, which, in the language of the ancient inhabitants, signifies *river*; a name, however, which does not seem to

Fountain. to have been given it on account of its yielding much water, for in that respect it hardly deserves the name of a fountain. More to the northward is another called *Hapio*; and in the middle of the island is a spring, yielding a stream about the thickness of a man's finger. This last was discovered in the year 1565, and is called the *fountain of Anton. Hernadez*. On account of the scarcity of water, the sheep, goats, and swine, here do not drink in the summer, but are taught to dig up the roots of fern, and chew them to quench their thirst. The great cattle are watered at those fountains, and at a place where water distils from the leaves of a tree. Many writers have made mention of this famous tree, some in such a manner as to make it appear miraculous: others again deny the existence of any such tree: among whom is Father Feyjoo, a modern Spanish author, in his Theatro Critico. But he, and those who agree with him in this matter, are as much mistaken as those who would make it appear to be miraculous. This is the only island of all the Canaries which I have not been in; but I have sailed with natives of Hierro, who, when questioned about the existence of this tree, answered in the affirmative.

"The author of the *History of the discovery and conquest* has given us a particular account of it, which I shall here relate at large.

"The district in which this tree stands is called *Tigulahe*; near to which, and in the cliff or steep rocky ascent that surrounds the whole island, is a narrow gutter or gully, which commences at the sea, and continues to the summit of the cliff, where it joins or coincides with a valley, which is terminated by the steep front of a rock. On the top of this rock grows a tree, called in the language of the ancient inhabitants *Garse*, "Sacred or Holy Tree," which for many years has been preserved sound, entire, and fresh. Its leaves constantly distil such a quantity of water as is sufficient to furnish drink to every living creature in Hierro; nature having provided this remedy for the drought of the island. It is situated about a league and a half from the sea. It is not certainly known of what species it is, only that it is called *Til*. It is distinct from other trees, and stands by itself; the circumference of the trunk is about 12 spans, the diameter four, and in height from the ground to the top of the highest branch, 40 spans: the circumference of all the branches together is 120 feet. The branches are thick and extended; the lowest commence about the height of an ell from the ground. Its fruit resembles the acorn, and tastes something like the kernel of a pine apple, but is softer and more aromatic. The leaves of this tree resemble those of the laurel, but are larger, wider, and more curved; they come forth, in a perpetual succession, so that the tree always remains green. Near to it grows a thorn which it fastens on many of its branches, and interweaves with them; and at a small distance from the garse are some beech trees, bresos, and thorns. On the north side of the trunk are two large tanks or cisterns, of rough stone, or rather one cistern divided, each half being 20 feet square, and 16 spans in depth. One of these contains water for the drinking of the inhabitants: and the other that which they use for their cattle, washing, and such like purposes. Every morning, near this part of the island, a cloud or mist arises from the sea, which the south and easterly winds force against the fore-mentioned steep cliff; so that the cloud having no vent but by the gutter, gradually ascends it, and from thence advances slowly to the extremity of the valley, where it is stopped and checked by the front of the rock which terminates the valley, and then rests upon the thick leaves and wide-spreading branches of the tree, from whence it distils in drops during the remainder of the day, until it is at length exhausted, in the same manner that we see water drip from the leaves of trees after a heavy shower of rain. This distillation is not peculiar to the garse or til; for the bresos, which grow near it, likewise drop water; but their leaves being but few and narrow, the quantity is so trifling, that though the natives save some of it, yet they make little or no account of any but what distils from the til, which, together with the water of some fountains, and what is saved in the winter season, is sufficient to serve them and their flocks. This tree yields most water in those years when the Levant or easterly winds have prevailed for a continuance; for, by these winds only the clouds or mists are drawn hither from the sea. A person lives on the spot near which this tree grows, who is appointed by the council to take care of it and its water; and is allowed a house to live in, with a certain salary. He every day distributes to each family of the district seven pots or vessels full of water, besides what he gives to the principal people of the island."

"Whether the tree which yields water at this present time be the same as that mentioned in the above description, I cannot pretend to determine: but it is probable there has been a succession of them; for Pliny, describing the Fortunate islands, says, "In the mountains of Ombrion are trees resembling the plant ferula, from which water may be procured by pressure. What comes from the black kind is bitter, but that which the white yields is sweet and potable.""

Trees yielding water are not peculiar to the island of Hierro; for travellers inform us of one of the same kind in the island of St Thomas, in the bight or gulf of Guinea. In Cockburn's voyages we find the following account of a dropping tree, near the mountains of Vera Paz, in America.

"On the morning of the fourth day, we came out on a large plain, where were great numbers of fine deer, and in the middle stood a tree of unusual size, spreading its branches over a vast compass of ground. Curiosity led us up to it. We had perceived, at some distance off, the ground about it to be wet; at which we began to be somewhat surprised, as well knowing there had no rain fallen for near six months past, according to the certain course of the season in that latitude: that it was impossible to be occasioned by the fall of dew on the tree, we were convinced, by the sun's having power to exhale away all moisture of that nature a few minutes after its rising. At last, to our great amazement as well as joy, we saw water dropping, or as it were distilling, fast from the end of every leaf of this wonderful (nor had it been amiss if I had said *miraculous*) tree; at least it was so with respect to us, who had been labouring four days through extreme heat, without receiving the least moisture, and were now almost expiring for want of it.

"We could not help looking on this as liquor sent from heaven to comfort us under great extremity. We catched

catched what we could of it in our hands, and drank very plentifully of it; and liked it so well, that we could hardly prevail with ourselves to give over. A matter of this nature could not but incite us to make the strictest observations concerning it; and accordingly we staid under the tree near three hours, and found we could not fathom its body in five times. We observed the soil where it grew to be very strong; and upon the nicest inquiry we could afterwards make, both of the natives of the country and the Spanish inhabitants, we could not learn there was any such tree known throughout New Spain, nor perhaps all America over: but I do not relate this as a prodigy in nature, because I am not a philosopher enough to describe any natural cause for it; the learned may perhaps give substantial reasons in nature for what appeared to us a great and marvellous secret."

FOUQUIERES, James, an eminent painter, was born at Antwerp in 1580, and received his chief instructions from Velvet Breughel. He applied himself to the study of landscapes, and went to Italy to improve himself in colouring. He succeeded so happily, that his works are said to be nearly equal to those of Titian. —He was engaged and much caressed at the court of the elector Palatine, and in France. By some misconduct, however, he sunk into poverty, and died in 1659, in the house of an inconsiderable painter. He had resided for several years at Rome and Venice, where he acquired that excellent style of colouring and design for which his works have been distinguished.

FOURCHEE, or Fourchy, in *Heraldry*, an appellation given to a cross forked at the end. See Heraldry.

FOURCROY, Antony Francis de, a late celebrated French chemist. See Supplement.

FOURMONT, Stephen, professor of the Arabic and Chinese languages, and one of the most learned men of his time, was born at Herbelai, a village four leagues from Paris, in 1683. He studied in Mazarine college, and afterwards in the Seminary of Thirty-three. He was at length professor of Arabic in the Royal College, and was made a member of the Academy of Inscriptions. In 1738, he was chosen a member of the Royal Society of London, and of that of Berlin in 1741. He was often consulted by the duke of Orleans, first prince of the blood; who had a particular esteem for him, and made him one of his secretaries. He wrote a great number of books; the most considerable of those which have been printed are, 1. The Roots of the Latin Tongue, in verse. 2. Critical Reflections on the Histories of ancient Nations, 2 vols. 4to. 3. *Meditationes Sinicæ*, folio. 4. A Chinese Grammar, in Latin, folio. 5. Several dissertations printed in the Memoirs of the Academy of Inscriptions, &c. He died at Paris in 1744.

He ought not to be confounded with *Michael Fourmont*, his youngest brother; who took orders, was professor of the Syriac language in the Royal College, and a member of the Academy of Inscriptions. He died in 1746.

FOURNESS, in Loynsdale, Lancashire, is a tract, between the Kent, Leven, and Dudden sands, which runs north parallel with the west sides of Cumberland and Westmoreland; and on the south runs out into the sea as a promontory. Here, as Mr Camden expresses it, "the sea, as if enraged at it, lashes it more furiously, and in high tides has even devoured the shore, and made three large bays; viz. Kentsand, into which the river Ken empties itself; Levensand and Duddensand, between which the land projects in such a manner that it has its name hence; Foreness and Foreland, signifying the same with us as *promontorium anterius* in Latin." Bishop Gibson, however, derives the name of *Fourness* or *Furness*, from the numerous furnaces that were there anciently, the rents and services of which (called *Bloomsmithy rents*) are still paid. This whole tract, except on the coast, rises in high hills and vast piles of rocks called *Fourness-Fells;* among which the Britons found a secure retreat, trusting to these natural fortresses, though nothing was inaccessible to the victorious Saxons; for we find the Britons settled here 228 years after the arrival of the Saxons: because at that time Egfrid king of Northumberland gave St Cuthbert the land called *Carthmell*, and all the Britons in it, as is related in his life. In these mountainous parts are found quarries of a fine durable blue slate to cover buildings with, which are made use of in many other parts of the kingdom. Here are several cotton mills lately erected; and if fuel for fire were more plentiful, the trade of this country would much increase: but there being no coals nearer than Wigan or Whitehaven, and the coast duties high, firing is rather scarce, the country people using only turf or peat, and that begins to be more scarce than formerly. In the mosses of Fourness much fir is found, but more oak: the trunks in general lie with their heads to the east, the high winds having been from the west. High Furness has ever had great quantities of sheep, which browse upon the hollies left in great numbers for them; and produces charcoal for melting iron ore, and oak bark for tanners use, in great abundance. The forests abound with deer and wild boars, and the *legh* or *scofe*, or large stags, whose horns are frequently found under ground here. The low or plain part of Fourness, which is so called to distinguish it from the woody or mountainous part, produces all sorts of grain, but principally oats, whereof the bread eaten in this country is generally made; and there are found here veins of a very rich iron ore, which is not only melted and wrought here, but great quantities are exported to other parts to mix with poorer ores. The three sands above mentioned are very dangerous to travellers, by the tides and the many quicksands. There is a guide on horseback appointed to Kent or Lancaster sands at 10l. per ann. to Leven at 6l. per ann. out of the public revenue; but to Dudden, which are most dangerous, none; and it is no uncommon thing for persons to pass over in parties of 100 at a time like caravans, under the direction of the carriers, who go to or fro every day. The sands are less dangerous than formerly, being more used and better known, and travellers never going without the carriers or guides. "Furnis abbey up in the mountains," was begun at Tulket in Amounderness 1124, by Stephen earl of Boulogne, afterwards king of England, for the monks of Savigni in France, and three years after removed to this valley, then called *Bekangesgill*, or, "the vale of nightshade." It was of the Cistertian order, endowed with

above

above 800l. per ann. Out of the monks of this abbey, Mr Camden informs us, the bishops of the Isle of Man, which lies opposite to it, used to be chosen by ancient custom; it being as it were the mother of many monasteries in Man and Ireland. Some ruins, and part of the fosse which surrounded the monastery, are still to be seen at Tulket. The remains at Fourness breathe that plain simplicity of the Cistertian abbeys; the chapter-house was the only piece of elegant Gothic about it, and its roof has lately fallen in. Part of the painted glass from the east window, representing the crucifixion, &c. is preserved at Windermere church in Bowlness, Westmoreland. The church (except the north side of the nave), the chapter-house, refectory, &c. remain, only unroofed.

FOURTH REDUNDANT, in *Music*. See INTERVAL.

FOWEY, or FOY, a town of Cornwall in England, 240 miles from London, with a commodious haven on the Channel. It contained 1319 inhabitants in 1811, and extends above one mile on the east side of a river of its own name; and has a great share in the fishing trade. It rose so much formerly by naval wars and piracies, that in the reign of Edward III. its ships refusing to strike when required as they sailed by Rye and Winchelsea, were attacked by the ships of those ports, but defeated them; whereupon they bore their arms mixed with the arms of those two cinque-ports, which gave rise to the name of the "Gallants of Fowey." And we learn from Camden, that this town quartered a part of the arms of every one of the cinque-ports with their own; intimating, that they had at times triumphed over them all: and indeed once they were so powerful, that they took several of the French men of war. In the reign of Edward III. they rescued certain ships of Rye from distress, for which this town was made a member of the cinque-ports. Edward IV. favoured Fowey so much, that when the French threatened to come up the river to burn it, he caused two towers, the ruins of which are yet visible, to be built at the public charge for its security: but he was afterwards so disgusted with the inhabitants for attacking the French after a truce proclaimed with Louis XI. that he took away all their ships and naval stores, together with a chain drawn across the river between the two forts above mentioned, which was carried to Dartmouth. It is said they were so insolent, that they cut off the ears of the king's pursuivants; for which some lives were forfeited as well as estates. The corporation consists of a mayor, recorder, 8 aldermen, a town clerk, and 2 assistants. The market is on Saturday, the fairs May-day and Sept. 10. Here are a fine old church, a free school, and an hospital. The toll of the market and fairs, and keyage of the harbour, were vested in the corporation on the payment of a fee-farm rent of about 40s. It does not appear to have sent members to parliament before the 13th of Queen Elizabeth. Here is a coinage for the tin; of which a great quantity is dug in the country to the north and west of it. The river Foy, or Foath, is very broad and deep here, and was formerly navigable as high as Lestwithiel. W. Long. 5. N. Lat. 50.27.

FOWL, among zoologists, denotes the larger sorts of birds, whether domestic or wild: such as geese, pheasants, partridges, turkeys, ducks, &c.

Tame fowl make a necessary part of the stock of a country farm. See POULTRY.

Fowls are again distinguished into two kinds, viz. *land* and *water* fowl, these last being so called from their living much in and about water: also into those which are accounted *game*, and those which are not. See GAME.

FOWLING, the art of catching birds by means of bird-lime, decoys, and other devices, or the killing of them by the gun. See *BIRD-Catching*, *BIRD-Lime*, DECOY, SHOOTING, and the names of the different birds in the order of the alphabet.

FOWLING, is also used for the pursuing and taking birds with hawks, more properly called FALCONRY or HAWKING. See these articles.

FOWLING Piece, a light gun for shooting birds. That piece is always reckoned best which has the longest barrel, from $5\frac{1}{2}$ to 6 feet, with a moderate bore; though every fowler should have them of different sizes, suitable to the game he designs to kill. The barrel should be well polished and smooth within, and the bore of an equal bigness from one end to the other; which may be proved, by putting in a piece of pasteboard, cut of the exact roundness of the top: for if this goes down without stops or slipping, you may conclude the bore good. The bridge-pan must be somewhat above the touch-hole, and ought to have a notch to let down a little powder: this will prevent the piece from recoiling, which it would otherwise be apt to do. As to the locks, choose such as are well filled with true work, whose springs must be neither too strong nor too weak. The hammer ought to be well hardened, and pliable to go down to the pan with a quick motion.

FOX, in *Zoology*. See CANIS, MAMMALIA *Index*.

The fox is a great nuisance to the husbandman, by taking away and destroying his lambs, geese, poultry, &c. The common way to catch him is by gins; which being baited, and a train made by drawing raw flesh across in his usual paths or haunts to the gin, it proves an inducement to bring him to the place of destruction.

The fox is also a beast of chase, and is taken with greyhounds, terriers, &c. See HUNTING.

FOX, *John*, the martyrologist, was born at Boston in Lincolnshire, in the year 1517. At the age of 16 he was entered a student of Brazen-Nose college in Oxford; and in 1543 he proceeded master of arts, and was chosen fellow of Magdalen college. He discovered an early genius for poetry, and wrote several Latin comedies, the subjects taken from Scripture, which his son assures us were written in an elegant style. Forsaking the muses, he now applied himself with uncommon assiduity to the study of divinity, particularly church-history; and, discovering a premature propensity to the doctrine of reformation, he was expelled the college as an heretic. His distress on this occasion was very great; but it was not long before he found an asylum in the house of Sir Thomas Lucy of Warwickshire, who employed him as a tutor to his children. Here he married the daughter of a citizen of Coventry. Sir Thomas's children being now grown up, after residing a short time with his wife's father, he came to London; where finding no immediate means of subsistence, he was reduced to the utmost degree of want; but was at length

length (as his son relates) miraculously relieved in the following manner: As he was one day sitting in St Paul's church, emaciated with hunger, a stranger accosted him familiarly, and, bidding him to be of good cheer, put a sum of money into his hand; telling him, at the same time, that in a few days new hopes were at hand. He was soon after taken into the family of the duchess of Richmond, as tutor to the earl of Surrey's children, who, when their father was sent to the Tower, were committed to her care. In this family he lived at Ryegate in Surrey, during the latter part of the reign of Henry VIII. the entire reign of Edward VI. and part of that of Queen Mary: but at length, persecuted by his implacable enemy Bishop Gardiner, he was obliged to seek refuge abroad. Basil in Switzerland was the place of his retreat, where he subsisted by correcting for the press. On the death of Queen Mary he returned to England; where he was graciously received by his former pupil the duke of Norfolk, who retained him in his family as long as he lived, and bequeathed him a pension at his death. Mr Secretary Cecil also obtained for him the rectory of Shipton near Salisbury; and we are assured that he might have had considerable church preferment, had it not been for his unwillingness to subscribe to the canons. He died in the year 1587, in the 70th year of his age; and was buried in the chancel of St Giles's, Cripplegate. He was a man of great industry, and considerable learning; a zealous, but not a violent reformer; a nonconformist, but not an enemy to the church of England. He left two sons; one of whom was bred a divine, the other a physician. He wrote many pieces; but his principal work is, the Acts and Monuments of the Church, &c. commonly called *Fox's Book of Martyrs.* His facts are not always to be depended on, and he often loses his temper; which, considering the subject, is not much to be wondered at.

Fox, *George*, the founder of the sect of English Quakers, was a shoemaker in Nottingham. The accounts of those times tell us, that as he wrought at his trade, he used to meditate much on the Scriptures; which, with his solitary course of life, improving his natural melancholy, he began at length to fancy himself inspired; and in consequence thereof set up for a preacher. He proposed but few articles of faith, insisting chiefly on moral virtue, mutual charity, the love of God, and a deep attention to the inward motions and secret operations of the Spirit; he required a plain simple worship, and a religion without ceremonies, making it a principal point to wait in profound silence the directions of the Holy Spirit. Fox met with much rough treatment for his zeal, was often imprisoned, and several times in danger of being knocked on the head, But all discouragements notwithstanding, his sect prevailed much, and many considerable men were drawn over to them; among whom were Barclay and Penn. He died in 1681. His followers were called *Quakers.* See Quakers.

Fox, *Right Honourable Charles James*, a late distinguished British statesman and orator. See Supplement.

Fox-Glove. See Digitalis, Botany and Materia Medica *Index.*

Fox Islands, the name of a group of islands, 16 in number, situated between the eastern coast of Kamtschatka and the western coast of the continent of America. Each island has a particular name; but the general name *Fox Islands* is given to the whole group, on account of the great number of black, gray, and red foxes with which they abound. The dress of the inhabitants consist of a cap, and a fur coat which reaches down to the knee. Some of them wear common caps of a party-coloured bird skin, upon which they leave part of the wings and tail. On the fore part of their hunting and fishing caps, they place a small board like a skreen, adorned with the jaw bones of sea bears, and ornamented with glass beads, which they receive in barter from the Russians. At their festivals and dancing parties they use a much more showy sort of caps. They feed upon the flesh of all sorts of sea animals, and generally eat it raw. But if at any time they choose to dress their victuals, they make use of a hollow stone; having placed the fish or flesh therein, they cover it with another, and close the interstices with lime or clay. They then lay it horizontally upon two stones, and light a fire under it. The provision intended for keeping is dried without salt in the open air. Their weapons consist of bows, arrows, and darts; and for defence they use wooden shields. The most perfect equality reigns among these islanders. They have neither chiefs nor superiors, neither laws nor punishments. They live together in families, and societies of several families united, which form what they call a *race*, who, in case of an attack or defence, mutually help and support each other. The inhabitants of the same island always pretend to be of the same race; and every person looks upon his island as a possession, the property of which is common to all the individuals of the same society. Feasts are very common among them, and more particularly when the inhabitants of one island are visited by those of the others. The men of the village meet their guests beating drums, and preceded by the women, who sing and dance. At the conclusion of the dance, the hosts serve up their best provisions, and invite their guests to partake of the feast. They feed their children when very young with the coarsest flesh, and for the most part raw. If an infant cries, the mother immediately carries it to the seaside, and whether it be summer or winter, holds it naked in the water, until it is quiet. This custom is so far from doing the children any harm, that it hardens them against the cold, and they accordingly go barefooted through the winter without the least inconvenience. They seldom heat their dwellings; but when they are desirous of warming themselves, they light a bundle of hay, and stand over it; or else they set fire to train-oil, which they pour into a hollow stone. They have a good share of plain natural sense, but are rather slow of understanding. They seem cold and indifferent in most of their actions; but let an injury, or even a suspicion only, rouse them from this phlegmatic state, and they become inflexible and furious, taking the most violent revenge without any regard to the consequences. The least affliction prompts them to suicide; the apprehension of even an uncertain evil often leads them to despair; and

 they

they put an end to their days with great apparent insensibility.

FRACASTOR, Jerome, an eminent Italian poet and physician, was born at Verona in the year 1482. Two singularities are related of him in his infancy: one is, that his lips adhered so closely to each other when he came into the world, that a surgeon was obliged to divide them with his incision knife; the other, that his mother was killed with lightning, while he, though in her arms at the very moment, escaped unhurt. Fracastor was of parts so exquisite, and made such progress in every thing he undertook, that he became eminently skilled not only in the belles lettres, but in all arts and sciences. He was a poet, a philosopher, a physician, an astronomer, and a mathematician. He was a man of vast consequence in his time; as appears from Pope Paul III.'s making use of his authority to remove the council of Trent to Bologna, under the pretext of a contagious distemper, which, as Fracastor deposed, made it no longer safe to continue at Trent. He was intimately acquainted with Cardinal Bembus, Julius Scaliger, and all the great men of his time. He died of an apoplexy at Casi near Verona, in 1553: and in 1559, the town of Verona erected a statue in honour of him.

He was the author of many performances, both as a poet and a physician: yet never man was more disinterested in both these capacities than he: evidently so as a physician, for he practised without fees; and as a poet, whose usual reward is glory, nothing could be more indifferent. It is owing to this indifference, that we have so little of his poetry, in comparison of what he wrote; and that, among other compositions, his Odes and Epigrams, which were read in manuscript with infinite admiration, yet, never passing the press, were lost. What we have now of his, are the three books of "Siphilis, or of the French disease;" a book of Miscellaneous Poems; and two books of his poem, entitled *Joseph*, which he began at the latter end of his life, but did not live to finish. And these works, it is said, would have perished with the rest, if his friends had not taken care to preserve and communicate copies of them: For Fracastor, writing merely for amusement, never troubled himself in the least about what became of his works after they once got out of his hands. Fracastor composed also a poem, called *Alcon, sive de cura canum venaticorum.* His poems as well as his other works are all written in Latin. His medical pieces are, *De Sympathia et Antipathia,—De contagione et contagiosis morbis,—De causis criticorum dierum,—De vini temperatura*, &c. His works have been printed separately and collectively. The best edition of them is that of Padua 1234, in 4 vols. 4to.

FRACHES, in the glass trade, are the flat iron pans into which the glass vessels already formed are put when in the tower over the working furnace, and by means of which they are drawn out through the leers, that they may be taken gradually from the fire, and cool by degrees.

FRACTION, in *Arithmetic* and *Algebra*, a part or division of an unit or integer; or a number which stands to an unit in the relation of a part to its whole. The word literally imports a broken number.

Fractions are usually divided into decimal, sexagesimal, and vulgar. See Algebra and Arithmetic.

FRACTURE, in *Surgery*, a rupture of a bone or a solution of continuity in a bone when it is crushed or broken by some external cause. See Surgery *Index*.

FRÆNUM, or Frenum, *Bridle*, in *Anatomy*, a name given to divers ligaments, from their office in retaining and curbing the motions of the parts they are fitted to.

Frænum Linguæ, or *Bridle of the Tongue;* a membranous ligament, which ties the tongue to the os hyoides, larynx, fauces, and lower parts of the mouth. In some subjects the *frænum* runs the whole length of the tongue to the very tip; in which cases, if it were not cut, it would take away all possibility of speech. See *Tongue-Tied.*

Frænum Penis, a slender ligament, whereby the prepuce is tied to the lower parts of the glans of the penis. Nature varies in the make of this part; it being so short in some, that unless divided it would not admit of perfect erection. There is also a kind of little *frænum*, fastened to the lower part of the clitoris.

FRAGA, a strong town with a handsome castle, in the kingdom of Arragon in Spain. It is strong by situation among the mountains; having the river Cinca before it, whose high banks are difficult of access; and at its back a hill, which cannot easily be approached with large cannon. Alphonso VII. king of Arragon, and the first of that name of Castile, was killed by the Moors in 1134, when he besieged this town. E. Long. 0. 23. N. Lat. 41. 28.

FRAGARIA, the Strawberry, a genus of plants belonging to the icosandria class; and in the natural method ranking under the 35th order, *Senticosæ.* See Botany *Index;* and for an account of the varieties and culture, see Gardening *Index.*

FRAIL, a basket made of rushes or the like, in which are packed up figs, raisins, &c. It signifies also a certain quantity of raisins, about 75 pounds.

FRAISE, in *Fortification*, a kind of defence consisting of pointed stakes, six or seven feet long, driven parallel to the horizon into the retrenchments of a camp, a half moon, or the like, to prevent any approach or scalade.

Fraises differ from pallisades chiefly in this, that the latter stand perpendicular to the horizon, and the former jet out parallel to the horizon, or nearly so, being usually made a little sloping, or with the points hanging down. Fraises are chiefly used in retrenchments and other works thrown up of earth; sometimes they are found under the parapet of a rampart, serving instead of the cordon of stone used in stone works.

To Fraise a Battalion, is to line the musqueteers round with pikes, that in case they should be charged with a body of horse, the pikes being presented, may cover the musqueteers from the shock, and serve as a barricade.

FRAME, in *Joinery*, a kind of case, wherein a thing is set or inclosed, or even supported; as a window frame, a picture frame, &c.

Frame is also a machine used in divers arts; as,

Frame, among printers, is the stand which supports the cases. See Case.

Frame,

Frame. FRAME, among founders, a kind of ledge enclosing a board; which, being filled with wetted sand, serves as a mould to cast their works in. See FOUNDERY.

FRAME is more particularly used for a sort of loom, whereon artificers stretch their linens, silks, stuffs, &c. to be embroidered, quilted, or the like.

FRAME, among painters, a kind of square, consisting of four long slips of wood joined together, whose intermediate space is divided by threads into several little squares like a net; and hence sometimes called *reticula*. It serves to reduce figures from great to small; or, to augment their size from small to great.

Frame || Franc.

FRAMLINGHAM, a town in Sussex, 88 miles from London. It is a large old place, with a castle, supposed to have been built by some of the first kings of the East Angles; the walls yet standing, are 44 feet high, 8 thick, with 13 towers 14 feet above them, two of which are watch-towers. Population 1965 in 1811.

FRANC. See FRANK.

FRANCE.

France.

FRANCE, a large kingdom of Europe, situated between 5° W. and 8° E. Long. and between 42° and 51° N. Lat. being bounded by the English channel and the Netherlands on the north; by Germany, Switzerland, Savoy, and Piedmont, on the east; by the Mediterranean sea, and the Pyrenean mountains, which separate it from Spain, on the south; and by the bay of Biscay on the west.

1 First subdued by Julius Cæsar.

The kingdom of France was originally possessed by the *Celtes* or *Gauls*. They were a very warlike people, and often checked the progress of the Roman arms: nor did they yield till the time of Julius Cæsar, who totally subdued their country, and reduced it to the form of a Roman province *. The Romans continued in quiet possession of Gaul, as long as their empire retained its strength, and they were in a condition to repress the incursions of the German nations, whom even in the zenith of their power they had not been able to subdue. But in the reign of the emperor Valerian, the ancient Roman valour and discipline had begun to decline, and the same care was not taken to defend the provinces as formerly. The barbarous nations, therefore, began to make much more frequent incursions; and among the rest the *Franks*, a German nation, inhabiting the banks of the Rhine, proved particularly troublesome. Their origin is variously accounted for; but the most probable supposition is, that about the time of the emperor Gordian, the people inhabiting the banks of the Lower Rhine, entered into a confederacy with those who dwelt on the Weser, and both together assumed the name of *Franks* or *Freemen*. Their first irruption, we are told by Valesius, happened in the year 254, the second of Valerian's reign. At this time they were but few in number; and were repulsed by Aurelian, afterwards emperor. Not discouraged by this check, they returned two years after in far greater numbers; but were again defeated by Gallienus, whom Valerian had chosen for his partner in the empire. Others, however, continued to pour in from their native country in such multitudes, that Gallienus, no longer able to drive them out by force of arms, made advantageous proposals to one of their chiefs, whom he engaged to defend the frontiers against his countrymen as well as other invaders.

* See *Gaul*.

2 Invaded by the Franks.

This expedient did not long answer the purpose. In 260 the Franks, taking advantage of the defeat and captivity of Valerian in Persia, broke into Gaul, and afterwards into Italy, committing everywhere dreadful ravages. Five years afterwards they invaded Spain; which they possessed, or rather plundered, for the space of 12 years: nor could they be driven out of Gaul till the year 275, when the emperor Probus not only gave them a total overthrow in that country, but pursued them into their own, where he built several forts to keep them in awe. This intimidated them so much, that nine of their kings submitted to the emperor, and promised an annual tribute.—They continued quiet till the year 287; when, in conjunction with the Saxon pirates, they plundered the coasts of Gaul, carrying off an immense booty. To revenge this insult, the emperor Maximian entered the country of the Franks the following year, where he committed such ravages that two of their kings submitted to him; and to many of the common people who chose to remain in Gaul, he allowed lands in the neighbourhood of Treves and Cambray.

The restless disposition of the Franks, however, did not allow them to remain long in quiet. About the year 293, they made themselves masters of Batavia and part of Flanders; but were entirely defeated, and forced to surrender at discretion, by Constantius the father of Constantine the Great, who transplanted them into Gaul. Their countrymen in Germany continued quiet till the year 306, when they renewed their depredations; but being overtaken by Constantine the Great, two of their kings were taken prisoners, and thrown to the wild beasts in the shows exhibited on that occasion.

All these victories, however, as well as many others said to have been gained by the Romans, were not sufficient to prevent the incursions of this restless and turbulent nation: insomuch that, in the year 355, they had made themselves masters of 40 cities in the province of Gaul. Soon after, they were totally defeated by the emperor Julian, and again by Count Theodosius, father to the emperor of that name; but in the year 388, they ravaged the province with more fury than ever, and cut off a whole Roman army that was sent against them. As the western empire was at this time in a very low state, they for some time found more interruption from other barbarians than from the Romans, till their progress was checked by Aetius.

3 Pharamond the first king.

When the war with Aetius broke out, the Franks were governed by one *Pharamond*, the first of their kings of whom we have any distinct account. He is supposed to have reigned from the year 417 or 418, to 428; and is thought by Archbishop Usher to have been killed in the war with Aetius. By some he is supposed

supposed to have compiled the Salic laws, with the assistance of four sages named *Wisegast*, *Losegast*, *Widegast*, and *Solegast*. But Valesius is of opinion that the Franks had no written laws till the time of Clovis.

4
Clodio.

Pharamond was succeeded by his son Clodio, who likewise carried on a war against the Romans. He is said to have received a terrible overthrow from Aetius near the city of Lens; notwithstanding which, he advanced to Cambray, and made himself master of that city, where for some time he took up his residence. After this he extended his conquests as far as the river Somme, and destroyed the cities of Treves and Cologne, Tournay and Amiens. He died in the year 448, and was succeeded by Merovæus.

5
Merovæus.

Authors are not agreed whether the new king was brother, or son, or any relation at all, to Clodio. It seems probable indeed, that he was of a different family; as from him the first race of French kings were styled *Merovingian*. He was honoured and respected by his people, but did not greatly enlarge the boundaries of his kingdom. He died in 458.

6
Childeric.

Merovæus was succeeded by his son Childeric; who being no longer kept in awe by Aetius, made war on the Romans, and extended his conquests as far as the river Loire. He is said to have taken the city of Paris after a siege of five years, according to some, and of ten, according to others. The Roman power was now totally destroyed in Italy; and therefore *Clodovæus*, *Clovis*, or *Louis*, for his name is differently written, who succeeded Childeric, set himself about making an entire conquest of Gaul. Part of the province was still retained by a Roman named *Syagrius*, who probably had become sovereign of the country on the downfall of the western empire in 476. He was defeated and taken prisoner by Clovis, who afterwards caused him to be beheaded, and soon after totally reduced his dominions.

7
French monarchy established by Clovis.

Thus was the French monarchy established by Clovis in the year 487. He now possessed all the country lying between the Rhine and the Loire; which, though a very extensive dominion, was yet considerably inferior to what it is at present.

Clovis had been educated in the Pagan religion, and continued in that profession till the 30th year of his age; notwithstanding which, he allowed his subjects full liberty of conscience. Having married, however, Clotilda, daughter of the duke of Burgundy; this princess, who was a zealous Christian, used all her influence with her husband to persuade him to embrace her religion. For some time he continued to waver; but happening to gain a battle, where, being in great danger, he had invoked the god of Clotilda and the Christians, he afterwards gave such a favourable ear to the discourses of Remigius bishop of Rheims, that he soon declared himself a convert, and was baptized in the year 496. His acknowledgment of the truths of the gospel was not followed by any amendment of life; on the contrary, he employed the remainder of his life in the aggrandizement of himself and extension of his dominions by the most abominable treachery, fraud, and violence. In his attacks on Armorica he proved unsuccessful. The inhabitants of this country, which comprehended the maritime part of ancient Gaul lying between the rivers Seine and Loire, had united for their defence; and though abandoned by the Romans, made a powerful defence against the barbarians who assaulted them on all sides. Clovis, finding them too powerful to be subdued by force, proposed an union with his people, which they readily accepted, and this the more easily on account of his professing the Christian religion. Thus the Christianity of Clovis in several instances proved subservient to the purposes of his ambition, and his power became gradually very formidable. The Burgundians at this time possessed all the country from the forest of Vosges to the sea of Marseilles, under Gondebaud the uncle of Clotilda; who, to secure his own authority, had put to death two of his brothers, one of whom was the father of the French queen. The third brother, *Godagesil*, whom he had spared and allowed to possess the principality of Geneva, conspired with Clovis to drive him from his dominions. A war having commenced between the French and Burgundian monarchs, the latter was deserted in a battle by Godagesil, and obliged to fly to Avignon, leaving his antagonist master of the cities of Lyons and Vienne. The victor next laid siege to Avignon; but it was defended with such vigour, that Clovis at last thought proper to accept of a sum of money and an annual tribute from Gondebaud; who was likewise obliged to cede to Godagesil the city of Vienne, and several other places taken during the war.

Gondebaud no sooner found himself at liberty from his enemies, than he assembled a powerful army; with which he advanced towards Vienne, where Godagesil himself resided at that time. The place was garrisoned by 5000 Franks, and might have made considerable resistance; but Gondebaud being admitted through the subterraneous passage of an aqueduct, massacred most of the Franks, sent the rest prisoners to the king of the Visigoths, and put Godagesil to death. This was quickly followed by the submission of all the other places which had owned the authority of Godagesil: and Gondebaud, now thinking himself able to resist the power of Clovis, sent a message to inform him, that he must no longer expect the promised tribute; and though Clovis was very much mortified with this defection, he found himself obliged for the present to put up with the injury, and accept of the alliance and military service of the king of Burgundy.

His next expedition was against the Visigoths, who possessed considerable territories on both sides of the Pyrenean mountains. His motives for this undertaking were expressed in the following speech to his nobility when assembled in the city of Paris, which he considered as the capital of his dominions. "It is with concern (said the religious monarch) that I suffer the Arians to possess the most fertile part of Gaul: let us, with the aid of God, march against them; and having conquered them, annex their kingdom to our dominions." The nobility approved of the scheme; and Clovis marched against a prince for whom he had but lately professed the greatest regard, vowing to erect a church in honour of the holy apostles, if he succeeded in his enterprise. Alaric the king of the Visigoths was a young man destitute of military experience, though personally brave. He did not therefore hesitate at engaging his antagonist; but unable to contend with the veteran troops of Clovis, his army was utterly defeated on the banks of the Clain, 10 miles

 miles south of Poictiers, in the year 507. Alaric, perceiving the ruin of his troops, rushed against Clovis in person, by whom he was killed, and the remainder of the army pursued for some time with great slaughter. After this victory the province of Aquitaine submitted, and Clovis established his winter quarters at Bourdeaux. Thoulouse surrendered next spring: and the royal treasures of the Visigoths were transported to Paris. Angouleme was next reduced, and the city of Arles invested. But here the victorious career of Clovis was stopped by Theodoric king of the Ostrogoths, who had overturned the dominion of Odoacer in Italy. He had married Abolfleda the sister of Clovis, but had also given his own daughter in marriage to the king of the Visigoths, and had endeavoured, as much as was in his power, to preserve a good understanding between the two sovereigns. Finding this impossible, however, and that no bounds could be set to the ambition of Clovis, he sent one of his generals with a powerful army against him; by whom the French monarch was defeated with the loss of 30,000 men. By this misfortune Clovis was obliged to raise the siege of Arles with precipitation: however, the Franks still retained the greatest part of their conquests, and the province of Aquitaine was indissolubly annexed to their empire.

8
honoured with the title of Roman consul.

In 509, Clovis had the title of Roman consul; by which means the people of Rome were insensibly led to pay a peculiar regard to the French monarchs: and Clovis was now supposed to be invested with a just title to all his conquests in whatever manner they had been acquired. He was solemnly invested with his new dignity in the church of St Martin in the city of Tours; after which he entered the cathedral clothed in a purple tunic and mantle, the badges of his office.

Clovis now proceeded to augment his power by the murder of his kinsmen the princes of the Merovingian race. Among those who perished on this occasion were Sigebert king of Cologne, with his son Cloderic; Cararic, another prince whose dominions have not been accurately pointed out by historians; Ranacaire, who governed the present diocese of Cambray; and Renomer, king of the territory of Maine. All these murders, however, were expiated, according to the views of the clergy of those times, by the great zeal he expressed in the cause of Christianity, and his liberality to the church.

Clovis died in the year 511, after having reformed and published the Salic laws: a few lines of which, debarring women from inheriting any part of the Salic lands, have been extended so far as to deprive the females of the royal family of France of their right of succession to the throne of that kingdom.

9
His dominions divided among his children.

Clovis was buried in the church of St Peter and St Paul, now Genevieve, in the city of Paris, where his tomb is still to be seen. His dominions were divided among his four sons. Thieri, or Theodoric, the eldest, had the eastern part of the empire: and, from his making the city of Metz his capital, is commonly called the *king of Metz*. Clodomir, the eldest son by Clotilda, had the kingdom of Orleans; Childebert, and Clotaire, who were both infants, had the kingdoms of Paris and Soissons, under the tutelage of their mother. The prudence of Clotilda kept matters quiet in all the parts of the empire for eight years; but about the year 520, a numerous fleet of Danes arrived at the mouth of the Meuse; and their king Cochiliac, having landed his forces, began to destroy the country with fire and sword. Against him Thieri sent his son Theodobert, who defeated the Danish army and navy, and killed their king, forcing the rest to retire with precipitation.

In 522, Hermanfroi king of Thuringia, having destroyed one of his brethren named *Berthaire*, and seized on his dominions, applied to Thieri for assistance against his other brother Balderic, whom he intended to treat in the same manner. In this infamous enterprise Thieri embarked, on condition that he should have one half of Balderic's dominions; but after the unhappy prince was overcome and killed in battle, Hermanfroi seized all his dominions. Thieri had no opportunity of revenging himself till the year 531; when perceiving the power of the Ostrogoths, whom he much dreaded, to be considerably lessened by the death of King Theodoric, he engaged his brother Clotaire to assist him: and they accordingly entered Thuringia with two powerful armies. They joined their forces as soon as they had passed the Rhine, and were quickly after reinforced by a considerable body of troops under the command of Theodobert. The allies attacked the army of Hermanfroi, which was advantageously posted; and having totally defeated it, he was forced to fly from place to place in disguise. Soon after this the capital was taken, and Hermanfroi himself being invited to a conference by Thieri, was treacherously murdered; after which his extensive dominions became feudatory to Thieri.

In the mean time, Clotilda had excited her children to make war on the Burgundians, in order to revenge the death of her father Chilperic, whom Gondebaud king of Burgundy had caused to be murdered. Gondebaud was now dead, and had left his dominions to his sons Sigismund and Godemar. Sigismund's forces were quickly defeated; and he himself was soon after delivered up by his own subjects to Clodomir, who caused him to be thrown into a pit where he perished miserably. By his death Godemar became sole master of Burgundy. Clodomir marched against him, and defeated him; but pursuing his victory too eagerly, was surrounded by his enemies and slain. After the reduction of Thuringia, however, Childebert and Clotaire entered the kingdom of Burgundy at the head of a powerful army, and in 534 completed the conquest of it; in which, according to some, Godemar was killed; according to others, he retired into Spain, and from thence into Africa.

In 560 Clotaire became sole monarch of France. He had murdered the sons of Clodomir, who was killed in Burgundy as above related. Thieri and his children were dead, as was also Childebert; so that Clotaire was sole heir to all the dominions of Clovis. He had five sons; and the eldest of them, named *Chramnes*, had some time before rebelled against his father in Auvergne. As long as Childebert lived, he supported the young prince; but on his death, Chramnes was obliged to implore his father's clemency. He was at this time pardoned; but he soon began to cabal afresh, and engaged the count of Bretagne to assist him in another rebellion. The Bretons, however, were defeated, and Chramnes determined to make his escape; but perceiving

10
Clotaire becomes sole monarch.

ing that his wife and children were surrounded by his father's troops, he attempted to rescue them. In this attempt he was taken prisoner, and with his family was thrust into a thatched cottage near the field of battle; of which the king was no sooner informed, than he commanded the cottage to be set on fire, and all that were in it perished in the flames.

11 The empire again divided.

Clotaire did not long survive this cruel execution of his son, but died in 562; and after his death the French empire was divided among his four remaining sons, Caribert, Gontran, Sigebert, and Chilperic.—The old king made no division of his dominions before he died, which perhaps caused the young princes to fall out sooner than they would otherwise have done. After his death, however, they divided the kingdom by lot; when Caribert, the eldest, had the kingdom of Paris; Gontran, the second, had Orleans; Sigebert, had Metz (or the kingdom of Austrasia); and Chilperic had Soissons. Provence and Aquitain were possessed by all of them in common. The peace of the empire was first disturbed in 563 by an invasion of the Abares; a barbarous nation, said to be the remains of the Hunns. They entered Thuringia, which belonged to the dominions of Sigebert: but by him they were totally defeated, and obliged to repass the Elbe with precipitation. Sigebert pursued them close, but readily concluded a peace with them on their first proposals. To this he was induced, by hearing that his brother Chilperic had invaded his dominions, and taken Rheims and some other places in the neighbourhood. Against him, therefore, Sigebert marched with his victorious army, made himself master of Soissons his capital, and of the person of his eldest son Theodobert. He then defeated Chilperic in battle; and not only recovered the places which he had seized, but conquered the greater part of his dominions: nevertheless, on the mediation of the other two brothers, Sigebert abandoned all his conquests, set Theodobert at liberty, and thus restored peace to the empire.

12 Infamous conduct of Chilperic.

Soon after this, Sigebert married Brunehaut daughter to Athanagilde king of the Visigoths in Spain; and in a little time after the marriage, died Caribert king of Paris, whose dominions were divided among his three brethren. In 567 Chilperic married Galswintha, Brunehaut's eldest sister, whom he did not obtain without some difficulty. Before her arrival, he dismissed his mistress called *Fredegonde*, a woman of great abilities and firmness of mind, but ambitious to the highest degree, and capable of committing the blackest crimes in order to gratify her ambition. The queen, who brought with her immense treasures from Spain, and made it her whole study to please the king, was for some time entirely acceptable. By degrees, however, Chilperic suffered Fredegonde to appear again at court, and was suspected of having renewed his intercourse with her; which gave such umbrage to the queen, that she desired leave to return to her own country, promising to leave behind her all the wealth she had brought. The king knowing that this would render him extremely odious, found means to dissipate his wife's suspicions, and soon after caused her to be privately strangled, upon which he publicly married Fredegonde.

Such an atrocious action could not fail of exciting the greatest indignation against Chilperic. His dominions were immediately invaded by Sigebert and Gontran, who conquered the greatest part of them; after which they suddenly made peace, Chilperic consenting that Brunehaut should enjoy those places which on his marriage he had bestowed upon Galswintha, viz. Bourdeaux, Limoges, Cahors, Bigorre, and the town of Bearn, now called *Lescar*.

The French princes, however, did not long continue at peace among themselves. A war quickly ensued, in which Gontran and Chilperic allied themselves against Sigebert. The latter prevailed; and having forced Gontran to a separate peace, seemed determined to make Chilperic pay dear for his repeated perfidy and infamous conduct; when he was assassinated by a contrivance of Fredegonde, who thus saved herself and Chilperic from the most imminent danger. Immediately on his death, Brunehaut fell into the hands of Chilperic; but Gondebaud, one of Sigebert's best generals, made his escape into Austrasia with Childebert, the only son of Sigebert, an infant of about five years of age, who was immediately proclaimed king in room of his father. In a short time, however, Meroveus, eldest son to Chilperic, fell in love with Brunehaut, and married her without acquainting his father. Chilperic on this news, immediately went to Rouen, where Meroveus and his consort were; and having seized them, sent Brunehaut and her two daughters to Metz, and carried Meroveus to Soissons. Soon after one of his generals being defeated by Gontran, who espoused Brunehaut's cause, Chilperic, in a fit of rage, caused Meroveus to be shaved and confined in a monastery. From hence he found means to make his escape, and with great difficulty arrived in Austrasia, when Brunehaut would gladly have protected him; but the jealousy of the nobles was so strong, that he was forced to leave that country; and being betrayed into the hands of his father's forces, was murdered at the instigation of Fredegonde, as was generally believed. 13 Sigebert assassinated.

The French empire was at this time divided between Gontran king of Orleans, called also king of Burgundy, Chilperic king of Soissons, and Childebert king of Austrasia. Chilperic found his affairs in a very disagreeable situation. In 579, he had a dispute with Varoc count of Bretagne, who refused to do him homage. Chilperic dispatched a body of troops against him; who were defeated, and he was then forced to submit to a dishonourable peace. His brother and nephew lived in strict union, and had no reason to be very well pleased with him. His own subjects, being oppressed with heavy taxes, were miserably poor and discontented. His son Clovis, by a former queen named *Andovera*, hated Fredegonde, and made no secret of his aversion. To add to his embarrassment, the seasons were for a long time so unfavourable, that the country was threatened with famine and pestilence at the same time. The king and queen were both attacked by an epidemic disease which then raged. They recovered; but their three sons Clodobert, Samson, and Dagobert, died; after which, the sight of Clovis became so disagreeable to Fredegonde, that she caused him to be murdered, and likewise his mother Andovera, lest Chilperic's affection for her should return after the tragical death of her son.

In 583 Chilperic himself was murdered by some unknown assassins, when his dominions were on the point of 14 and likewise Chilperic.

France. of being conquered by Gontran and Childebert, who had entered into a league for that purpose. After his death Fredegonde implored the protection of Gontran for herself and her infant son Clotaire; which he very readily granted, and obliged Childebert to put an end to the war. He found himself, however, greatly difficulted to keep Fredegonde and Brunehaut in awe; for these two princesses having been long rivals and implacable enemies, were continually plotting the destruction of each other. This, however, he accomplished, by favouring sometimes Brunehaut and sometimes Fredegonde; so that, during his life, neither of them durst undertake any thing against the other.

15 Death of Gontran; On the 28th of March 593, died Gontran, having lived upwards of 60, and reigned 32 years. Childebert succeeded to the kingdom without opposition, but did not long enjoy it; he himself dying in the year 596, and his queen shortly after. His dominions were divided between his two sons Theodobert and Thierri; the first of whom was declared king of Austrasia, and the latter king of Burgundy. As Theodobert was only in the 11th year of his age, and Thierri in his 10th, Brunehaut governed both kingdoms with an absolute sway. Fredegonde, however, took care not to let slip such a favourable opportunity as was offered her by the death of Childebert, and therefore made herself mistress of Paris and some other places on the Seine. Upon this Brunehaut sent against her the best part of

16 and Fredegonde. the forces in Austrasia, who were totally defeated; but Fredegonde died before she had time to improve her victory, leaving her son Clotaire heir to all her dominions.

For some time Brunehaut preserved her kingdom in peace; but in the end her own ambition proved her ruin. Instead of instructing Theodobert in what was necessary for a prince to know, she took care rather to keep him in ignorance, and even suffered him to marry a young and handsome slave of his father's. The new queen was possessed of a great deal of affability and good nature; by which means she in a short time gained the affection of her husband so much, that he readily

17 Brunehaut banished. consented to the banishment of Brunehaut. Upon this disgrace she fled to Thierri king of Burgundy, in the year 599. By him she was very kindly received; and instead of exciting jealousies or misunderstandings between the two brothers, she engaged Thierri to attempt the recovery of Paris and the other places which had been wrested from their family by Fredegonde, procuring at the same time a considerable body of auxiliaries from the Visigoths. This measure was so acceptable to Theodobert, that he likewise raised a numerous army, and invaded Clotaire's dominions in conjunction with his brother. A battle ensued, in which the forces of Clotaire were totally defeated, and himself obliged soon after to sue for peace: which was not granted, but on condition of his yielding up the best part of his dominions.

This treaty was concluded in the year 600; but three years afterwards, it was broken by Clotaire. He was again attacked by the two brothers, and the war carried on with great vigour till the next spring. At this time Thierri having forced Landri, Clotaire's general, to a battle, gave him a total overthrow, in which the king's infant son Meroveus, whom he had sent along with Landri, was massacred; to gratify, as Clotaire pretended, the malice of Brunehaut. After this victory, Thierri marched directly to Paris; fully bent on the destruction of his cousin, which now seemed inevitable. This, however, was prevented by Theodobert; who no sooner heard of the victory gained by Thierri, than he became jealous of his success, and offered Clotaire such terms of peace as he gladly accepted. The latter having then nothing to fear on the side of Austrasia, quickly compelled Thierri to listen to terms of accommodation also.

This behaviour of Theodobert greatly provoked his brother; and his resentment was highly inflamed by Brunehaut, who never forgot her disgrace in being banished from his court. A war was therefore commenced between the two brothers in 605; but it was so highly disapproved of by the nobility, that Thierri found himself obliged to put an end to it. The tranquillity which now took place was again disturbed in 607, by Theodobert's sending an embassy to demand some part of Childebert's dominions, which had been added by the will of that monarch to those of Burgundy. The nobility of both kingdoms were so much averse to war, that they constrained their kings to consent to a conference, attended by an equal number of troops; but Theodobert, by a scandalous breach of his faith, brought double the number, and compelled his brother to submit to what terms he pleased. This piece of treachery instantly brought on a war; for Thierri was bent on revenge, and his nobility no longer opposed him. It was necessary, however, to secure Clotaire by a negotiation; and accordingly a promise was made of restoring those parts of his dominions which had formerly been taken from him, provided he would remain quiet. This treaty being finished, Thierri entered Theodobert's dominions, defeated him in two battles, took him prisoner, used him with the utmost indignity; and having caused an infant son of his to be put to death, sent him to his grandmother Brunehaut. By her orders he was first shaved and confined in a monastery; but afterwards, fearing lest he should make his escape, she caused him to be put to death.—Clotaire, in the mean time, thought that the best method of making Thierri keep his word was to seize on those places which he had promised to restore to him, before his return from the war with Theodobert. This he accordingly did; and Thierri no sooner heard of his having done so, than he sent him a message requiring him to withdraw his forces, and, in case of his refusal, declared war. Clotaire was prepared for this; and accordingly assembled all the forces in his dominions, in order to give him a proper reception. But before Thierri could reach his enemies, he was seized with a dysentery; of which he died in the year 612, having lived 26 years, and reigned 17. 18 Death of Thierri.

On the death of Thierri, Brunehaut immediately caused his eldest son, named *Sigisbert*, then in the 10th year of his age, to be proclaimed king. It is probable that she intended to have governed in his name with an absolute sway; but Clotaire did not give her time to discover her intentions. Having great intelligence in Austrasia and Burgundy, and knowing that the nobility in both kingdoms were disaffected to Brunehaut, he declared war against her; and she being betrayed by her generals, fell into the hands of her enemies. Clotaire gave her up to the nobles; who generally

France.

19 Brunehaut put to a cruel death.

hated her, and who used her in the most cruel manner. After having led her about the camp, exposed to the insults of all who had the meanness to insult her, she was tied by the leg and arm to the tail of an untamed horse, which, setting off at full speed, quickly dashed out her brains. After this her mangled body was reduced to ashes, which were afterwards interred in the abbey of St Martin at Autun.

Thus in the year 613, Clotaire became sole monarch of France; and quietly enjoyed his kingdom till his death, which happened in 628. He was succeeded by Dagobert; who proved a great and powerful prince, and raised the kingdom of France to a high degree of splendour. Dagobert was succeeded by his sons Sigebert and Clovis; the former of whom had the kingdom of Austrasia, and the latter that of Burgundy. Both the kings were minors at the time of their accession to the throne, which gave an opportunity to the mayors of the palace (the highest officers under the crown) to usurp the whole authority. Sigebert died in 640, after a short reign of one year; leaving behind him an infant son named *Dagobert*, whom he strongly recommended to the care of Grimoalde his mayor of the palace. The minister caused Dagobert to be immediately proclaimed king, but did not long suffer him to enjoy that honour. He had not the cruelty, however, to put him to death; but sent him to a monastery in one of the Western islands of Scotland; and then, giving out that he was dead, advanced his own son Childebert to the throne. Childebert was expelled by Clovis king of Burgundy; who placed on the throne Childeric, the second son of Sigebert. Clovis died soon after the revolution, and was succeeded in his dominions by his son Clotaire; who died in a short time, without issue. He was succeeded by his brother Childeric; who, after a short reign, was murdered with his queen, at that time big with child, and an infant son named *Dagobert;* though another, named *Daniel*, had the good luck to escape.

20 Miserable situation of France.

The affairs of the French were now in the most deplorable situation. The princes of the Merovingian race had been for some time entirely deprived of their power by their officers called *mayors of the palace*. In Austrasia the administration had been totally engrossed by Pepin and his son Grimaulde; while Archambaud and Ebroin did the same in Neustria and Burgundy. On the reunion of Neustria and Burgundy to the rest of the Freuch dominions, this minister ruled with such a despotic sway, that the nobility of Austrasia were provoked to a revolt; electing for their dukes two chiefs named *Martin* and *Pepin*. The forces of the confederates, however, were defeated by Ebroin; and Martin having surrendered on a promise of safety, was treacherously put to death. Pepin lost no time in recruiting his shattered forces; but before he had any occasion to try his fortune a second time in the field of battle, the assassination of Ebroin delivered him from all apprehensions from that quarter. After his death, Pepin carried every thing before him, overthrew the royal army under the command of the new minister Bertaire; and, having got possession of the capital, caused himself to be declared mayor of the palace; in which station he continued to govern with an absolute sway during the remainder of his life.

Pepin (who had got the surname of *Heristal* from his palace on the Meuse) died in the year 714, having enjoyed unlimited power for 26 years. He appointed his grandson Theudobalde, then only six years of age, to succeed him in his post of mayor of the palace. This happened during the reign of Dagobert already mentioned; but this prince had too much spirit to suffer himself to be deprived of his authority by an infant. The adherents of the young mayor were defeated in battle, and this defeat was soon followed by his death.

21 Exploits of Charles Martel.

Charles, however, the illegitimate son of Pepin, was now raised to the dignity of duke by the Austrasians, and by his great qualities seemed every way worthy of that honour. The murder of Dagobert freed him from a powerful opponent; and the young king Chilperic, who after Dagobert's death was brought from a cloister to the throne, could by no means cope with such an experienced antagonist. On the 19th of March 717, Charles had the good fortune to surprise the royal camp as he passed through the forest of Arden; and soon after a battle ensued, in which the king's forces were entirely defeated. On this Chilperic entered into an alliance with Eudes duke of Aquitain, whose friendship he purchased by the final cession of all the country which Eudes had seized for himself. Charles, however, having placed on the throne another of the royal family named *Clotaire*, advanced against Chilperic and his associate, whom he entirely defeated near Soissons. After this disaster, Eudes, despairing of success, delivered up Chilperic into the hands of his antagonist: after having stipulated for himself the same terms which had been formerly granted him by the captive monarch.

Charles, now advanced to the summit of power, treated Chilperic with great respect; and on the death of Clotaire, caused him to be proclaimed king of Austrasia; by which, however, his own power was not in the least diminished; and from this time the authority of the kings of France became merely nominal; and so inactive and indolent were they accounted, that historians have bestowed upon them the epithet of *faineans*, i. e. "lazy or idle." Charles, however, had still one competitor to contend with. This was Rainfroy, who had been appointed mayor of the palace; and who made such a vigorous resistance, that Charles was obliged to allow him the peaceable possession of the country of Anjou. No sooner, however, had Charles thus set himself at liberty from domestic enemies, than he was threatened with destruction from foreign nations. The Suevians, Frisons, and Alemanni, were successively encountered and defeated. Eudes also, who had perfidiously broken the treaties to which he had bound himself, was twice repulsed; after which Charles invaded Aquitain, and obliged the treacherous duke to hearken to reason. This was scarce accomplished, when he found himself engaged with a more formidable enemy than any he had yet encountered. The Saracens having overrun great part of Asia, now turned their victorious arms westward, and threatened Europe with total subjection. Spain had already received the yoke; and having passed the Pyrenees, they next invaded France, appearing in vast numbers under the walls of Thoulouse. Here they were encountered and defeated by Eudes; but this proved only a partial check. The barbarians once more passing the Pyrenees, entered France with such a powerful army, that Eudes was no longer able to to resist. He encountered them indeed with his accustomed valour; but being forced to yield to superior power, he solicited the protection and assistance of Charles. On this occasion the latter, on account of his valour and personal strength, acqnired the name of *Martel*, i. e. "the hammer," alluding to the violence of the strokes he bestowed on his enemies†. Three hundred and seventy-five thousand of the Infidels, among whom was the commander Abdelrahman himself, are said to have perished in the battle; notwithstanding which they soon made another irruption: but in this they were attended with no better success, being again defeated by Charles; who by so many victories established his power on the most solid foundation. Having again defeated the Frisons, and with his own hand killed their duke, he assumed the sovereignty of the dominions of Eudes, after his decease, reserving to himself the claim of homage, which he ought to have yielded to Thierri his lawful sovereign. At last, his fame grew so great, that he was chosen by Pope Gregory III. for his protector. He offered to shake off the yoke of the Greek emperor, and to invest Charles with the dignity of Roman consul; sending him at the same time the keys of the tomb of St Peter; but while this negotiation was going on successfully, the pope, the emperor, and Charles Martel, himself, died. After his death, which happened in the year 741, his dominions were divided among his three sons, Carloman, Pepin, and Grippon, according to the dispositions he had made in his lifetime. By this, Carloman, the eldest, had Austrasia; Pepin, the second, Neustria and Burgundy; while Grippon, the third, had only some lands assigned him in France; by which he was so much displeased, that the tranquillity of the empire was soon disturbed. With the assistance of his mother Sonnechilde he seized on the city of Lahon, where he endured a violent siege. In the end, however, he was obliged to submit; Sonnechilde was put into a monastery, and Grippon imprisoned in a castle at Arden. The two brothers, having thus freed themselves from their domestic enemy, continued to govern the empire with uninterrupted harmony; but their tranquillity was soon disturbed by the intrigues of Sonnechilde. That enterprising and ambitious woman had negotiated a marriage between Odilon duke of Bavaria and Hiltrude the sister of the two princes. This was no sooner accomplished than Odilon, instigated by Sonnechilde, and alarmed at the growing power of the two princes, entered into an alliance with Theodobald duke of the Alemanni and Theodoric duke of the Saxons; who having assembled a formidable army, advanced directly against the princes. They posted themselves in an advantageous manner, with the river Lech in their front; but Carloman and Pepin, passing the river at different fords in the night time, attacked the camp of the allies with great vigour. The engagement continued doubtful for five hours; but at last the entrenchments were forced on all sides, the Bavarians and Saxons entirely routed, and the vanquished dukes obliged to submit to the clemency of the victors. During their absence on this expedition, Hunalde, whom Charles Martel had appointed duke of Aquitain, having likewise entered into a confederacy with Odilon, passed the Loire, ravaged the open country, and burnt the magnificent cathedral of the city of Chartres. The two princes, however, having returned with their victorious army, Hunalde found himself obliged to retreat: and even this availed him but little: for the Franks entering the duchy of Aquitain, committed such devastations, that Hunalde in despair resigned his dominions to his son, and retired into a convent. This event was soon followed by a similar resignation of Carloman, notwithstanding the uninterrupted success he had met with. He suddenly took the resolution of retiring into a convent, and persisted in his design notwithstanding the entreaties of Pepin, who, to appearance at least, did all he could to dissuade him.

† See *Arabia*, N°174.

22 France divided among the sons of Charles.

23 Pepin becomes sole master of the kingdom.

By the resignation of Carloman, which happened in the year 746, Pepin was left sole master of France; and in this exalted station he acquitted himself in such a manner as has justly rendered his name famous to posterity. One of the first acts of his new administration was to release his brother Grippon from prison: but that treacherous prince had no sooner regained his liberty, than he again excited the Saxons to take up arms. His enterprise, however, proved unsuccessful: the Saxons were defeated, their duke Theodoric taken, and his subjects obliged to submit to the will of the conqueror; who upon this occasion caused them make a profession of the Christian religion. Grippon then fled to Hiltrude, his half sister, whose husband Odilon was now dead, and had left an infant son named *Tassilon*. He met with a favourable reception from her; but with his usual treachery, seized both her and her son by the assistance of an army of malecontent Franks, whom he had persuaded to join him. His next step was to assume the sovereignty and title of duke of Bavaria; but being driven from the throne by Pepin, he was obliged to implore his clemency, which was once more granted. All these misfortunes, however, were not yet sufficient to cure Grippon of his turbulence and ambition: He once more endeavoured to excite disturbances in the court of Pepin; but being finally detected and baffled, he was obliged to take refuge in Aquitain.

24 Assumes the title of king.

Pepin having now subdued all his foes, both foreign and domestic, began to think of assuming the title of *king*, after having so long enjoyed the regal power. His wishes in this respect were quite agreeable to those of the nation in general. The nobility, however, were bound by an oath of allegiance to Childeric the nominal monarch at that time: and this oath could not be dispensed with but by the authority of the pope. Ambassadors for this purpose were therefore dispatched both from Pepin and the nobility to Pope Zachary, the reigning pontiff. His holiness replied, that it was lawful to transfer the regal dignity from hands incapable of maintaining it to those who had so successfully preserved it; and that the nation might unite in the same person the authority and title of *king*. On this the unfortunate Childeric was degraded from his dignity, shaved, and confined in a monastery for life; Pepin assumed the title of *king of France*, and the line of Clovis was finally set aside.

This revolution took place in the year 751. The attention of the new monarch was first claimed by a revolt of the Saxons; but they were soon reduced to subjection, and obliged to pay an additional tribute: and during this expedition against them, the king had the satisfaction of getting rid of his restless and treacherous competitor Grippon. This turbulent prince,

having

having soon become weary of residing at the court of Aquitain, determined to escape from thence, and put himself under the protection of Astolphus king of the Lombards; but he was killed in attempting to force a pass on the confines of Italy. Pepin in the mean time continued to push his good fortune. The submission of the Saxons was soon followed by the reduction of Brittany; and that by the recovery of Narbonne from the Infidels. His next exploit was the protection of Pope Stephen III. against Astolphus the king of the Lombards, who had seized on the exarchate of Ravenna, and insisted on being acknowledged king of Rome. The pope, unable to contend with such a powerful rival, hasted to cross the Alps and implore the protection of Pepin, who received him with all the respect due to his character. He was lodged in the abbey of St Dennis, and attended by the king in person during a dangerous sickness with which he was seized. On his recovery, Stephen solemnly placed the diadem on the head of his benefactor, bestowed the regal unction on his sons Charles and Carloman, and conferred on the three princes the title of *patrician of Rome*. In return for these honours, Pepin accompanied the pontiff into Italy at the head of a powerful army. Astolphus, unable to withstand such a powerful antagonist, shut himself up in Pavia, where he was closely besieged by the Franks, and obliged to renounce all pretensions to the sovereignty of Rome, as well as to restore the city and exarchate of Ravenna, and swear to the observance of the treaty. No sooner was Pepin gone, however, than Astolphus broke the treaty he had just ratified with such solemnity. The pope was again reduced to distress, and again applied to Pepin. He now sent him a pompous epistle in the style and character of St Peter himself; which so much inflamed the zeal of Pepin, that he instantly set out for Italy and compelled Astolphus a second time to submit to his terms, which were now rendered more severe by the imposition of an annual tribute. Pepin next made a tour to Rome; but finding that his presence there gave great uneasiness both to the Greeks aud to the pope himself, he thought proper to finish his visit in a short time. Soon after his return Astolphus died, and his dominions were usurped by his general Didier; who, however, obtained the papal sanction for what he had done, and was recognized as lawful sovereign of the Lombards in the year 756.

Pepin returned to France in triumph; but the peace of his dominions was soon disturbed by the revolt of the Saxons, who always bore the French yoke with the utmost impatience. Their present attempts, however, proved equally unsuccessful with those they had formerly made; being obliged to submit and purchase their pardon not only by a renewal of their tribute, but by an additional supply of 300 horse. But while the king was absent on this expedition, Vaisar duke of Aquitain took the opportunity of ravaging Burgundy, where he carried his devastations as far as Chalons. Pepin soon returned, and entering the dominions of Vaisar, committed similar devastations, and would probably have reduced the whole territory of Aquitain, had he not been interrupted by the hostile preparations of his nephew Tassilon the duke of Bavaria. The king, however, contented himself at present with securing his frontiers by a chain of posts, against any invasion; after which he resumed his enterprise on the dominions of Vaisar. The latter at first attempted to impede the progress of his antagonist by burning and laying waste the country: but finding this to no purpose, he determined to try his fortune in an engagement. Victory declared in favour of Pepin; but he refused to grant a peace upon any terms. The French monarch advanced to the banks of the Garonne; while Vaisar was abandoned by his ally the duke of Bavaria, and even by his own subjects. In this distress he retired with a band of faithful followers into the country of Saintonge, where he defended himself as long as possible, but was at last deprived both of his crown and life by the victor.

Thus the duchy of Aquitain was once more annexed to the crown of France; but Pepin had scarce time to indulge himself with a view of his new conquest when he was seized with a slow fever, which put an 25
end to his life in the year 768, the 54th of his age, Death of
and 17th of his reign. He was of a short stature, Pepin.
whence he had the surname of *Le Bref*, or *the Short*; but his great actions justly entitled him to the character of a hero: though under the succeeding reign his own fame seemed to have been entirely forgot, and on his tomb was only inscribed, "Here lies the father of Charlemagne." 26

Pepin was succeeded in his authority by his two Succeeded
sons Charles and Carloman; to whom with his dying by his two
breath he bequeathed his dominions. They continued sons.
to reign jointly for some time; but the active and enterprising spirit of Charles gave such umbrage to the weak and jealous Carloman, that he regarded him with envy, and was on the point of coming to an open rupture with him, when he himself was taken off by death, and thus the tranquillity of the empire was preserved.

The first military enterprise of Charles was against Hunalde, the old duke of Aquitain; who leaving the monastery where he had resided upwards of 20 years, assumed the royal title, and was joyfully received by his subjects, already weary of the French yoke.—Charles took the field with the utmost expedition, and with difficulty prevailed upon his brother Carloman, who was then alive, to join him with his forces. But the junction was scarce effected, when Carloman withdrew his forces again, and left his brother to carry on the war in the best manner he could. Charles, though thus deserted, did not hesitate at engaging the enemy; and having overthrown them in a great battle, Hunalde was obliged to fly to the territories of Lupus duke of Gascony. Charles quickly sent an embassy demanding the fugitive prince; and Lupus, not daring to disobey the orders of such a powerful monarch, yielded up the unfortunate Hunalde, who was instantly cast into prison, from which, however, he afterwards made his escape.

The death of Carloman, which happened in the year 27 Reign of
771, left Charles sole master of France, but the revolt Charles the
of the Saxons involved him in a series of wars from Great.
which he did not extricate himself for 33 years. These had long been tributaries to the French, but frequently revolted: and now, when freed from the terror of Pepin's arms, thought they had a right to shake off the yoke altogether. Charles entered their country with a powerful army; and having defeated them in a number

ber of small engagements, advanced towards Eresbourg near Paderborn, where they had their capital post, and where was the image of their god Irminsul, represented as a man completely armed, and standing on a column. The Saxons made an obstinate defence, but were at last obliged to submit; and Charles employed his army three days in demolishing the monuments of idolatry in this place; which so much disheartened the whole nation, that for the present they submitted to such terms as he pleased to impose; and which were rendered easier than they probably would have been, by the news which Charles now received from Italy.—He had concluded a marriage with the daughter of Didier king of the Lombards; but this had been dissolved by the pope, who reproached the Lombards with the first stain of the leprosy. Thus all friendship was dissolved betwixt Didier and Charles; and as the Lombard monarchs seem to have had a kind of natural enmity towards the popes, it is not surprising that it should now break out with uncommon fury. Didier having seized and frighted to death Pope Stephen IV. used his utmost endeavours to reduce his successor Adrian I. to a state of entire dependence on himself. Adrian applied to the French monarch, the usual resource of the pontiffs in those days. Charles was very willing to grant the necessary assistance, but the nobility were averse to an Italian war; so that he was obliged to act with great circumspection. Several embassies were therefore sent to Didier, entreating him to restore to the Pope those places which he had taken from him, and at last even offering him a large sum of money if he would do so; but this proposal being rejected, he obtained the consent of his nobility to make war on the Lombards. Didier disposed his troops in such a manner, that the officers of Charles are said to have been unanimously of opinion, that it would be impossible to force a passage. This, however, was accomplished, either through the superior skill of Charles, according to some historians, or a panic which seized the Lombard soldiers, according to others; after which Didier, with the old duke of Aquitain, who had escaped from his prison, and taken refuge at his court, shut themselves up in Pavia. Adalgise, the only son of the Lombard monarch, with the widow and children of Carloman, fled to Verona. That city was immediately invested by the conqueror, and in a short time obliged to submit. Adalgise had the good luck to escape to Constantinople, but we are not informed what became of Carloman's widow and children.—Charles, after paying a short visit to Rome, returned to the siege of Pavia. The place was vigorously defended, until famine and pestilence obliged the inhabitants to implore the clemency of Charles. Hunalde fell a sacrifice to his own obstinacy in opposing the intention of the people; Didier was taken prisoner and carried into France; but we are not informed of his fate afterwards. His kingdom, however, was totally dissolved, and Charles was crowned king of Lombardy at Milan in the year 774.

Having received the oaths of allegiance from his new subjects, Charles set out for Saxony, the inhabitants of which had again revolted, and recovered Eresbourg their capital. The king soon recovered this important post; but a detachment of his army being cut off, and new troubles arising in Italy, he was obliged to accept of the proposals of the Saxons, though their sincerity was very doubtful. Having therefore only strengthened the fortifications of Eresbourg, and left a sufficient garrison in the place, he set out for Italy, which was all in commotion through the intrigues of the emperor of the East, and Adalgise the son of Didier. The presence of Charles restored tranquillity in that quarter; but in the mean time, the Saxons having taken Eresbourg and destroyed the fortifications, threatened to annihilate the French power in that quarter. On the king's return, he found them employed in the siege of Sigebourg. His sudden arrival struck the barbarians with such terror, that they instantly sued for peace; which the king once more granted, but took care to secure their obedience by a chain of forts along the river Lippe, and repairing the fortifications of Eresbourg. An assembly of the Saxon chiefs was held at Paderborn, and a promise was made, that the nation should embrace the Christian religion: after which the king set out on an expedition to Spain in the year 778.

This new enterprise was undertaken at the request of Ibunala, the Moorish sovereign of Saragossa, who had been driven from his territory. He was restored, however, by the prowess of Charles, who reduced the cities of Pampeluna and Saragossa. He reduced also the city of Barcelona, and the kingdoms of Navarre and Arragon; but, on his return, he met with a severe check from the Gascons, who attacked and defeated the rear-guard of his army with great slaughter as they passed the Pyrenean mountains. This engagement, which seems to imply some defect in the prudence or military skill of Charles, has been much celebrated among romance writers, on account of the death of Roland a famous warrior.

Next year, 779, he paid a visit to Italy with his two sons Carloman and Louis. Having passed the winter at Pavia, he entered Rome next spring amidst the acclamations of the inhabitants. Here, in the 39th year of his age, he divided his dominions in presence of the pope betwixt his two sons Carloman and Louis. The former, who now took the name of Pepin, had Lombardy; the latter Aquitain. Having then received the submission of Tassilon duke of Bavaria, he set out for Saxony, where he took a most severe revenge on the people of that country for the many treacheries they had been guilty of. The present revolt was chiefly owing to a chief named Witikind, who had twice before fled from the victorious arms of Charles, and taken refuge at the court of Denmark. Returning from thence, in the king's absence, he roused his countrymen to action, while the generals of Charles, disagreeing among themselves, neglected to take the proper methods for repelling the enemy. In consequence of this, they were entirely defeated on the banks of the Weser in the year 782. Charles arrived in time to prevent the total destruction of his people, and directly penetrated into the heart of the country. Witikind unable to resist his antagonist, once more fled into Denmark; but 4500 of his followers perished at once by the hands of the executioner. An universal insurrection was the consequence of this unheard of cruelty; and though during three years the French monarch was constantly successful in the field, he found it impossible by any force whatever to subdue the spirit

spirit of the people. At last therefore he was obliged to have recourse to negotiation. Witikind and several other chiefs were invited to an interview; where Charles represented to them in such strong colours the ruin which must necessarily ensue to their country by persisting obstinately in opposition to him, that they were induced not only to persuade their countrymen finally to submit, but to embrace the Christian religion.

Charles having thus brought his affairs in Saxony to a happy conclusion, turned his arms against Tassilon duke of Bavaria, who had underhand supported the Saxons in their revolt. Having entered his country with a powerful army in the year 787, he made such rapid advances, that the total destruction of Tassilon seemed inevitable. Charles had advanced as far as the river Lech, when Tassilon privately entered his camp, and threw himself at his feet. The king had compassion on his faithless kinsman on seeing him in this abject posture; but no sooner did the traitor find himself at liberty, than he stirred up the Hunns, the Greek emperor, and the fugitive Adalgise, against the king. He fomented also the discontents of the factious nobles of Aquitain and Lombardy: but his subjects, fearing lest these intrigues should involve them in destruction, made a discovery of the whole to Charles. Tassilon, ignorant of this, entered the diet at Ingelheim, not suspecting any danger, but was instantly arrested by order of the French monarch. Being brought to a trial, the proofs of his guilt were so apparent, that he was condemned to lose his head; the punishment, however, was afterwards mitigated to perpetual confinement in a monastery, and the duchy of Bavaria was annexed to the dominions of Charles.

The Hunns and other enemies of the French monarch continued to prosecute their enterprises without regarding the fate of their associate Tassilon. Their attempts, however, only served to enhance the fame of Charles. He defeated the Hunns in Bavaria, and the Greek emperor in Italy; obliging the latter to renounce for ever the fortune of Adalgise. The Hunns, not disheartened by their defeat, continuing to infest the French dominions, Charles entered their country at the head of a formidable army; and having forced their intrenchments, penetrated as far as Raab on the Danube, but was compelled by an epidemic distemper to retire before he had finished his conquest. He was no sooner returned to his own dominions, than he had the mortification to be informed, that his eldest son Pepin had conspired against his sovereignty and life. The plot was discovered by a priest who had accidentally fallen asleep in a church where the conspirators were assembled. Being awakened by their voices, he overheard them consulting on the proper measures for completing their purpose; on which he instantly set out for the palace, and summoned the monarch from his bed to inform him of the guilt of his son. Pepin was seized, but had his life spared, though condemned to expiate his offences by spending the remainder of his days in a monastery.

Charles was no sooner freed from this danger than he was again called to arms by a revolt of the Saxons on the one hand, while a formidable invasion of the Moors distressed him on the other; the Hunns at the same time renewing their depredations on his dominions. The king did not at present make war against the Moors; probably foreseeing that they would be called off by their Christian enemies in Spain. This accordingly happened; the victories of Alonso the Chaste obliged them to leave France; after which Charles marched in person to attack the Saxons and Hunns. The former consented again to receive the Christian religion, but were likewise obliged to deliver up a third part of their army to be disposed of at the king's pleasure; but the Hunns defended themselves with incredible vigour. Though often defeated, their love of liberty was altogether invincible; so that the war was not terminated but by the death of the king, and an almost total destruction of the people: only one tribe could be induced to acknowledge the authority of the French monarch.

These exploits were finished betwixt the years 793 and 798: after which Charles invaded and subdued the islands of Majorca and Minorca; which the dissensions of the Moorish chiefs gave him an opportunity of doing. The satisfaction he felt from this new conquest, however, was soon damped by the troubles which broke out in Italy. After the death of Pope Adrian, his nephew aspired to the papal dignity; but a priest named Leo being preferred, the disappointed candidate determined on revenge. He managed matters so well, that his designs were concealed for four years. At last, on the day of a procession, a furious assault was made on the person of Leo. The unfortunate pontiff was left for dead on the ground; but having with difficulty recovered, and made his escape to the Vatican, he was protected by the duke of Spoleto, at that time general of the French forces. His cause was warmly espoused by Charles, who invited him to his camp at Paderborn in Westphalia; whence he dispatched him with a numerous guard to Rome, promising soon after to visit that metropolis, and redress all grievances. His attention for the present, however, was called by the descents of the Normans on the maritime provinces of his dominions; so that he was obliged to defer the promised assistance for some time longer. Having constructed forts at the mouths of most of the navigable rivers, and further provided for the defence of his territories, by instituting a regular militia, and appointing proper squadrons to cruise against the invaders, he set out for the fourth and last time on a journey to Rome. Here he was received with the highest possible honours. Leo was allowed to clear himself by oath of the crimes laid to his charge by the enemies, while his accusers were sent into exile. On the festival of Christmas, in the year 800, after Charles had made his appearance in the cathedral of St Peter, and assisted devoutly at mass, the pope suddenly put a crown on his head; and the place instantly resounded with acclamations of "Long life to Charles the Augustus, crowned by the hand of God! Long life and victory to the great and pacific emperor of the Romans!" His body was then consecrated and anointed with royal unction; and after being conducted to a throne, he was treated with all the respect usually paid to the ancient Cæsars; from this time also being honoured with the title of *Charlemagne*, or *Charles the Great*. In private conversation, however, he usually protested, that he was ignorant of the pope's intention at this time; and that, had he known it, he would have disappointed

28
He is crowned emperor of the West.

 disappointed him by his absence: but these protestations were not generally believed; and the care he took to have his new title acknowledged by the eastern emperors, evidently showed how fond he was of it.

Charles, now raised to the supreme dignity in the west, proposed to unite in himself the whole power of the first Roman emperors, by marrying Irene the empress of the East. But in this he was disappointed by the marriage of that princess by Nicephorus; however, the latter acknowledged his new dignity of Augustus, and the boundaries of the two empires were amicably settled. Charles was further gratified by the respect paid him by the great Haroun Al-Rashid, caliph of the Saracens, who yielded to him the sacred city of Jerusalem, and holy sepulchre there. But in the mean time his empire was threatened with the invasion of a very formidable enemy, whom even the power of Charles would have found it hard to resist. These were the Normans, at this time under the government of Godfrey a celebrated warrior, and who by their adventurous spirit, and skill in maritime affairs, threatened all the western coasts of Europe with desolation. From motives of mutual convenience a transitory peace was established, and Charles made use of this interval to settle the final distribution of his dominions. Aquitain and Gascony, with the Spanish Marche, were assigned to his son Louis; Pepin had Italy confirmed to him; and to this was added the greatest part of Bavaria, with the country now possessed by the Grisons. Charles the eldest had Neustria, Austrasia, and Thuringia. The donation was supposed to be rendered more authentic by the sanction of the pope. This division, however, had scarce taken place, when the princes were all obliged to defend their dominions by force of arms. Louis and Pepin were attacked by the Saracens, and Charles by the Sclavonians. All these enemies were defeated; but while Charles hoped to spend the short remainder of his life in tranquillity, he was once more called forth to martial exertions by the hostile behaviour of Godfrey the Norman leader. Charles sent him a message of defiance, which was returned in the same style by Godfrey: but the former, by artfully fomenting divisions among the northern powers, prevented for a while the threatened danger; but, these disturbances being quelled, the Normans renewed their depredations, and Charles was obliged to face them in the field. An engagement, however, was prevented by the death of Godfrey, who was assassinated by a private soldier; on which the Norman army retreated, and the dominions of the empire still remained free from these invaders. Still the latter days of Charles were embittered by domestic misfortunes. His favourite daughter Rotrude died, as did also Pepin king of Italy; and these misfortunes were soon followed by the death of his eldest son Charles. The emperor then thought proper to associate his only surviving son Louis with him in the government; which was formally done at Aix-la-Chapelle. Charles himself survived this transaction only a few months: his death happened on the 27th of January 814, in the 71st year of his age, and 47th of his reign.

29 Death of Charles the Great.

30 Extent of his territories.

By the martial achievements of this hero, the French monarchy was raised to its utmost pitch of splendour. He had added the province of Aquitain to the territories of his ancestors; he had confined the inhabitants of Brittany to the shores of the ocean, and obliged them to submit to a disgraceful tribute. He had reduced under his dominion all that part of Spain which extends from the Pyrenees to the river Ebro, and includes the kingdoms of Rousillon, Navarre, Arragon, and Catalonia. He possessed Italy from the Alps to the borders of Calabria; but the duchy of Beneventum, including most of the present kingdom of Naples, escaped the yoke after a transitory submission. Besides these extensive countries, Charles added to his territories the whole of Germany and Pannonia; so that the French now had the jurisdiction of all the country from east to west, from the Ebro in Spain to the Vistula; and from north to south, from the duchy of Beneventum to the river Eyder, the boundary between Germany and the dominions of Denmark. In acquiring these extensive dominions Charles had been guilty of horrid and repeated massacres, for which, however, he had been in some measure excusable by the barbarity and rebellious disposition of the people with whom he had to deal, upon whom no mild measures would probably have had any effect. His establishing of schools throughout the conquered provinces, showed also his inclination to govern his subjects in peace, and to take proper steps for their civilization; though indeed many parts of his private conduct showed no small inclination to cruelty; particularly the fate of the sons of Carloman, of whom no account could ever be obtained. His advice to his son Louis indeed was excellent; exhorting him to consider his people as his children; to be very mild and gentle in his administration, but firm in the execution of justice; to reward merit; promote his nobles gradually; choose ministers deliberately, but not remove them capriciously or without sufficient reason. All these prudent maxims, however, were not sufficient to enable Louis to govern dominions so extensive, and people so turbulent as he had to deal with. At the time of the decease of his father this prince was about 36 years of age, and had married Ermengarde, daughter of the count of Hesbai of the diocese of Liege, by whom he had three sons, Lothaire, Pepin, and Louis. Lothaire, the eldest, was associated with himself in the empire, and the two youngest were intrusted with the governments of Aquitain and Bavaria. Every one of the princes proved unfaithful to their father, as well as enemies to one another. The death of Ermengarde, and the marriage of the emperor with Judith a princess of Bavaria, artful but accomplished, proved the first source of calamity to the empire. In the year 823, Charles, the emperor's youngest son, was born; and his pretensions became in time more fatal to the public tranquillity than the ambition and disobedience of all the rest. Various parts of the Imperial dominions were likewise assaulted by foreign enemies. The inhabitants of Brittany and Navarre revolted; the Moors invaded Catalonia; while the ambition of Judith produced a war amongst the brothers themselves.

31 Decline of his empire.

32 Civil wars among the sons of Louis the Gentle.

Charles at first had been appointed sovereign of that part of Germany bounded by the rivers Danube, the Maine, the Neckar, and the Rhine; the country of the Grisons and Burgundy, comprehending Geneva and the Swiss cantons; but this was opposed by the three elder sons. Pepin and Louis advanced with the united forces of Aquitain and Bavaria, while the Imperial

perial

France. perial forces deserted their standard and joined the malecontents. The emperor was taken prisoner, and the empress retired to a monastery. Lothaire, the eldest of the younger princes, to whom the rest found themselves obliged to submit, was the person who retained the emperor in his possession; but notwithstanding his breach of duty, his heart was touched with remorse on account of the crimes he had committed. Dreading the reproach of the world at large, and being threatened with the censures of the church, he threw himself at his father's feet, and begged pardon for his guilt, consenting to relinquish the authority he had unjustly usurped. Thus Louis was re-established in his authority by the diet of the empire which had met to depose him. His first step was to recal his empress from the monastery to which she had retired; but this princess, implacable in her resentment, now persecuted Lothaire to such a degree, that he was obliged to join his two brothers Pepin and Louis in a confederacy against their father. The old emperor thought to check this rebellious disposition by revoking his grant of Aquitain to Pepin, and conferring it on his youngest son Charles, then only nine years of age; but Pope Gregory IV. conferred the Imperial dignity itself on Lothaire, deposing the unhappy monarch, and again sending the empress to a nunnery in the forest of Arden. The unnatural behaviour of his son, however, once more excited the compassion of his subjects. Dreux, the bishop of Mentz, used his interest with Louis king of Bavaria to arm his subjects in defence of his father and sovereign. In this enterprise the Bavarian monarch was joined by the French and Saxons; so that the aged emperor was once more restored, the empress released from her nunnery, and Charles from his prison, in the year 833.

The ambition of Judith now set matters once more in a flame. Taking advantage of the affection her husband bore her, she persuaded him to invest her son Charles with the sovereignty of Neustria as well as the dominions formerly assigned him. This was productive of great discontent on the part of Lothaire and Pepin; but their power was now too much broken to be able to accomplish any thing by force of arms. The death of Pepin, which happened soon after, produced a new division of the empire. The claims of young Pepin and Charles, sons of the deceased prince, were entirely disregarded, and his French dominions divided between the two brothers Charles and Lothaire, the latter being named guardian to his infant nephew. This enraged Louis of Bavaria, whose interest was entirely neglected in the partition, to such a degree, that he again revolted; but the unexpected appearance, with the hostile preparations of the Saxons, obliged him to submit and ask pardon for his offences. Still, however, the ambition of the empress kept matters in a continual ferment, and the empire was again threatened with all the calamities of civil war; but before these took place, the emperor died, in 841, after a most unfortunate reign of 27 years.

Louis was eminent for the mildness of his manners and peaceful virtues, which procured him the title of *Le Debonnaire*, or, "the gentle:" but such was the turbulence and excessive barbarity of the age in which he lived, that all his virtues, instead of procuring him respect and esteem, were productive only of contempt and rebellion from those whom both duty and nature ought to have rendered the most submissive and obedient. France.

The decease of the emperor was followed by a civil war among his sons. The united forces of Lothaire and his nephew Pepin were defeated by those of Charles and Louis in a very bloody battle in the plains of Fontenoy, where 100,000 Franks perished, in the year 842. This victory, however, bloody as it was, did not decide the fortune of the war. The conquerors having, through motives of interest or jealousy, retired each into their own dominions, Lothaire found means not only to recruit his shattered forces, but pressed the other two princes so vigorously, that they were glad to consent to a new partition of the empire. By this Lothaire was allowed to possess the whole of Italy, with the whole tract of country between the rivers Rhone and Rhine, as well as that between the Meuse and Scheldt. Charles had Aquitain, with the country lying between the Loire and the Meuse; while Louis had Bavaria, with the rest of Germany, from whence he was distinguished by the appellation of *Louis the Great*. 33

33 Division of the empire.

By this partition, Germany and France were disjoined in such a manner as never afterwards to be united under one head. That part of France which was allowed to Lothaire, was from him called *Lotharingia*, and now *Lorrain*, by the gradual corruption of the word. The sovereignty, however, which that prince had pursued at the expence of every filial duty, and purchased with so much blood, afforded him now but little satisfaction. Disgusted with the cares and anxieties of his situation, he sought relief in a monastery in the year 855. On his retreat from the throne, he allotted to his eldest son Louis II. the sovereignty of Italy; to his second son Lothaire the territory of Lorrain, with the title of king; and to his youngest son Charles, surnamed the *Bald*, Provence, Dauphiny, and part of the kingdom of Burgundy; so that he may be considered as properly the king of France. From the year 845 to 857 the provinces subjected to his jurisdiction had been infested by the annual depredations of the Normans, from whom Charles was at last fain to purchase peace at a greater expence than might have carried on a successful war. The people of Brittany had also revolted; and though obliged by the appearance of Charles himself, at the head of a powerful army, to return to their allegiance, they no sooner perceived him again embarrassed by the incursions of the Normans, than they threw off the yoke, and under the conduct of their duke Louis subdued the neighbouring diocese of Rennes; after which exploit Louis assumed the title of king, which he transmitted to his son Herispee. By him Charles was totally defeated; and his subjects, perceiving the weakness of their monarch, put themselves under the protection of Louis the German. His ambition prompted him to give a ready ear to the proposal; and therefore, taking the opportunity of Charles's absence in repelling an invasion of the Danes, he marched with a formidable army into France, and was solemnly crowned by the archbishop of Sens in the year 857. Being too confident of success, however, and fancying himself already established on the throne, he was persuaded to

34 Lothaire resigns.

35 Reign of Charles the Bald.

to dismiss his German forces; which he had no sooner done, than Charles marched against him with an army, and Louis abandoned his new kingdom as easily as he had obtained it.

Notwithstanding this success, the kingdom of Charles continued still in a very tottering situation. The Normans harassed him in one quarter, and the king of Brittany in another. He marched against the latter in the year 860; but had the misfortune to receive a total defeat, after an engagement which lasted two days. The victory was chiefly owing to a noted warrior named Robert le Fort, or the Strong, who commanded the Bretons; but Charles found means to gain him over to his party, by investing him with the title of duke of France, including the country which lies between the rivers Seine and Loire.

For some time the abilities of Robert continued to support the tottering throne of Charles; but the difficulties returned on the death of that hero, who was killed in repelling an invasion of the Danes. Some amends was indeed made for his loss by the death of the king of Lorrain in the year 869; by which event the territories of Charles were augmented by the cities of Lyons, Vienne, Toul, Besançon, Verdun, Cambray, Viviers and Urez, together with the territories of Hainault, Zealand, and Holland. Cologne, Utrecht, Treves, Mentz, Strasburg, with the rest of the territories of Lothaire, were assigned to Louis the German.

All this time the Normans still continued their incursions to such a degree, that Solomon king of Brittany was persuaded to join his forces to those of Charles, in order to repel the common enemy. The event proved unfortunate to the Normans; for their principal leaders were besieged in Angiers, and obliged to purchase leave to depart by relinquishing all the spoil they had taken. Charles thus freed from a formidable enemy, began to aspire to the Imperial crown, which about this time became vacant by the death of Louis. This belonged of right to Louis the German; but Charles, having instantly assembled a powerful army, marched with it into Italy before Louis could be apprised of his designs; and being favourably received at Rome, the Imperial crown was put on his head without any hesitation by the pope, in the year 873. Louis, enraged at his disappointment, discharged his fury on the defenceless country of Champagne; and though the approach of Charles obliged him for the present to retire, yet he continued his preparations with such vigour, that Charles would in all probability have found him a very formidable adversary, had he not been taken off by death in the year 877. Charles was no sooner informed of his brother's decease, than he invaded the dominions of his son Louis, who possessed Franconia, Thuringia, the Lower Lorrain, with some other territories in that quarter. The enterprise, however, proved unsuccessful. Charles, though superior in numbers, was defeated with great slaughter, and had scarcely time to reunite his scattered forces, when he was informed that the Normans had invaded his territories, laid waste part of that country, and taken possession of the city of Rouen. So may disasters affected him in such a manner that he fell dangerously ill, and was scarcely recovered of his sickness when he found himself called into Italy to the assistance of the pope against the Saracens, whose invasions were encouraged by the duke of Beneventum and the Greek emperor. Charles passed into Italy with only a few followers; but when he came to Pavia, at which place the pontiff had appointed to meet him, he was informed that Carloman king of Bavaria, and son of Louis the German, was already in Italy with a powerful army, and laid claim to the imperial title in virtue of his father's right. Charles prepared to oppose him by force of arms; but his generals conspired against him, and the soldiers declared their resolution not to pass the Alps. On this he was obliged to retire to France, at the very moment that Carloman, dreading his power, prepared to return to Germany. This was the last of Charles's enterprises. His journey brought on a return of his indisposition, which was rendered fatal through the treachery of a Jewish physician named Zedechius, who administered poison to him under pretence of curing his malady. He expired in a miserable cottage upon Mount Cenis, in the 54th year of his age, and 38th of his reign over the kingdom of France.

36 He is poisoned.

37 Reign of Louis the Stammerer.

The ambition of Charles had been productive of much distress both to himself and to his subjects. His son Louis, surnamed, from a defect in his speech, *the Stammerer*, was of a quite different disposition; but his feeble administration was ill calculated to retrieve matters in their present situation. He died on the 10th of April 879, while on a march to suppress some insurrections in Burgundy. He left his queen Adelaide pregnant; who some time after his decease was delivered of a son, named *Charles*. After his death followed an interregnum; during which a faction was formed for setting aside the children of Louis the Stammerer, in favour of the German princes, sons to Louis the brother of Charles the Bald. This scheme, however, proved abortive; and the two sons of the late king, Louis and Carloman, were crowned kings of France. Another kingdom was at that time erected by an assembly of the states, namely the kingdom of Provence, which consisted of the countries now called *Lyonnois*, *Savoy*, *Dauphiny*, *Franche Compte*, and part of the duchy of Burgundy; and the kingdom was given to Duke Boson, brother-in-law to Charles the Bald. In 881, both kings of France died; Louis, as was suspected, by poison; and Carloman, of a wound he received accidentally while hunting. This produced a second interregnum; which ended with the calling in of Charles the Gross, emperor of Germany. His reign was more unfortunate than that of any of his predecessors. The Normans, to whom he had given leave to settle in Friesland, sailed up the Seine with a fleet of 700 ships, and laid siege to Paris. Charles, unable to force them to abandon their undertaking, prevailed on them to depart by a large sum of money. But as the king could not advance the money at once, he allowed them to remain in the neighbourhood of Paris during the winter; and they in return plundered the country, thus amassing vast wealth besides the sum which Charles had promised. After this ignominous transaction Charles returned to Germany, in a very declining state of health both as to body and mind. Here he quarrelled with his empress; and being abandoned by all his friends, he was deposed, and reduced to such distress, that he would not even have had bread to eat, had

 had he not been supplied by the archbishop of Mentz, out of the principle of charity.

On the deposition of Charles the Gross, Eudes count of Paris was chosen king by the nobility during the minority of Charles the son of Adelaide, afterwards named *Charles the Simple*. He defeated the Normans, and repressed the power of the nobility; on which account a faction was formed in favour of Charles, who was sent for, with his mother, from England. Eudes did not enter into a civil war; but peaceably resigned the greatest part of the kingdom to him, and consented to do homage for the rest. He died soon after this agreement, in the year 898.

During the reign of Charles the Simple, the French government declined. By the introduction of fiefs, those noblemen who had got into the possession of governments, having these confirmed to them and their heirs for ever, became in a manner independent sovereigns: and as these great lords had others under them, and they in like manner had others under them, and even these again had their vassals; instead of the easy and equal government which prevailed before, a vast number of insupportable little tyrannies was erected. The Normans, too, ravaged the country in the most terrible manner, and desolated some of the finest provinces in France. At last Charles ceded to Rollo, the king or captain of these barbarians, the duchy of Neustria; who thereupon became a Christian, changed his own name to *Robert*, and that of his principality to *Normandy*.

During the remainder of the reign of Charles the Simple, and the entire reign of Louis IV. surnamed the *Stranger*, Lothaire, and Louis V. the power of the Carlovingian race continually declined; till at last they were supplanted by Hugh Capet, who had been created duke of France by Lothaire. This revolution happened in the year 987, and was brought about much in the same manner as the former one had been by Pepin. He proved an active and prudent monarch, and possessed such other qualities as were requisite for keeping his tumultuous subjects in awe. He died on the 24th of October 997, leaving his dominions in perfect quiet to his son Robert.

38 Family of Charles the Great supplanted by Hugh Capet.

39 Robert.

The new king inherited the good qualities of his father. In his reign the kingdom was enlarged by the death of Henry duke of Burgundy, the king's uncle, to whom he fell heir. This new accession of territory, however, was not obtained without a war of several years continuance, on account of some pretenders to the sovereignty of that duchy; and had it not been for the assistance of the duke of Normandy, it is doubtful whether the king would have succeeded.—As Robert was of opinion, that peace and tranquillity were preferable to wide extended dominions with a precarious tenure, he refused the kingdom of Italy and imperial crown of Germany, both which were offered him. He died on the 20th of July 1030; having reigned 33 years, and lived 60.

40 Henry I.

Robert was succeeded by his eldest son Henry I. who in the beginning of his reign met with great opposition from his mother. She had always hated him; and preferred his younger brother Robert, in whose favour she now raised an insurrection. By the assistance of Robert duke of Normandy, however, Henry overcame all his enemies, and established himself firmly upon the throne. In return for this, he supported William, Robert's natural son, and afterwards king of England, in the possession of the duchy of Normandy. Afterwards, however, growing jealous of his power, he not only supported the pretenders to the duchy of Normandy secretly, but invaded that country himself in their favour. This enterprise proved unsuccessful, and Henry was obliged to make peace: but no sincere reconciliation ever followed; for the king retained a deep sense of the disgrace he had met with, and the duke never forgave him for invading his dominions. The treaty between them, therefore, was quickly broken; and Henry once more invaded Normandy with two armies, one commanded by himself, and the other by his brother. The first was harassed by continual skirmishes, and the last totally defeated; after which Henry was obliged to agree to such terms as the duke thought proper; but the rancour between them never ceased, and was in reality the cause of that implacable aversion which for a long series of years produced perpetual quarrels between the kings of France and those of the Norman race in England.

Henry died in 1059, not without a suspicion of being poisoned; and was succeeded by his eldest son Philip, at that time in the eighth year of his age. Baldwin earl of Flanders was appointed his guardian; and died in the year 1066, about the time that William of Normandy became king of England. After the death of his tutor, Philip began to show a very insincere, haughty, and oppressive disposition. He engaged in a war with William the Conqueror, and supported his son Robert in his rebellion against him §. But after the death of William, he assisted Robert's brothers against him; by which means he was forced to consent to a partition of his dominions. 41 Philip.

§ See *England*, N° 89.

In 1092, King Philip being wearied of his queen Bertha, procured a divorce from her under pretence of consanguinity, and afterwards demanded in marriage Emma daughter to Roger count of Calabria. The treaty of marriage was concluded; and the princess was sent over, richly adorned with jewels, and with a large portion in ready money: but the king, instead of espousing her, retained her fortune, and dismissed the princess herself, carrying off from her husband the countess of Anjou, who was esteemed the handsomest woman in France. With her he was so deeply enamoured, that not satisfied with the illegal possession of her person, he procured a divorce between her and her husband, and prevailed upon some Norman bishops to solemnize his own marriage with her. The whole of these transactions, however, were so scandalous, that the pope having caused them to be revised in a council at Autun, in the year 1094, pronounced sentence of excommunication against Philip in case he did not part with the countess. On his repentance, the censure was taken off; but as the king paid no regard to his promises, he was, in 1095, excommunicated a second time. He again professed repentance, and was absolved; but soon after, living with the countess of Anjou as formerly, he was excommunicated a third time. This conduct, so unworthy of a prince, exposed him to the contempt of the people. Too many of the nobility followed his example, and at the same time despised his authority; not only making war upon on each other, but spoiling and robbing his subjects with impunity.

In the year 1110, Philip prevailed on the court of Rome to have his affaïr reviewed in an assembly at Poictiers; where, notwithstanding his utmost efforts, sentence of excommunication was a fourth time pronounced against him. Yet, in spite of all these sentences, as Queen Bertha was dead, and the count of Anjou offered, for a large sum of money, to give whatever assistance was requisite for procuring a dispensation, Philip at last prevailed, and the countess was proclaimed queen of France. But though the king's domestic affairs were now in some degree quieted, his negligence in government had thrown the affairs of the nation into the greatest disorder. He therefore associated with him in the government his eldest son Louis. This prince was the very reverse of his father; and by his activity and resolution, keeping constantly in the field with a considerable body of forces, he reduced the rebellious nobility to subjection, and according to the best historians, at this time saved the state from being utterly subverted.

For these services the queen looked upon the young prince with so jealous an eye, and gave him so much disturbance, that he found it necessary to retire for some time into England; where he was received by King Henry I. with the greatest kindness. He had not been long at court, before Henry received by an express a letter from Philip; telling him, that, for certain important reasons, he should be glad if he closely confined his son, or even despatched him altogether. The king of England, however, instead of complying with this infamous request, shewed the letter to Louis, and sent him home with all imaginable marks of respect. Immediately on his return he demanded justice; but the queen procured poison to be given him, which operated so violently that his life was despaired of. A stranger, however, undertook the cure, and succeeded; only a paleness remained in the prince's face ever afterwards, though he grew so fat that he was surnamed *the Gross.*

On his recovery, the prince was on the point of revenging his quarrel by force of arms; but his father having caused the queen to make the most humble submissions to him, his resentment was at length appeased, and a perfect reconciliation took place.

42 Louis the Gross. Nothing memorable happened in the reign of King Philip after this reconciliation. He died in the year 1118, and was succeeded by his son Louis the Gross. The first years of his reign were disturbed by insurrections of his lords in different places of the kingdom; and these insurrections were the more troublesome, as they were secretly fomented by Henry I. of England, that by weakening the power of France his duchy of Normandy might be the more secure. This quickly brought on a war; in which Henry was defeated, and his son William obliged to do homage to Louis for the duchy of Normandy. As the kings of England and France, however, were rivals, and exceedingly jealous of each other, the latter espoused the cause of William the son of Robert duke of Normandy, whom Henry had unjustly deprived of that duchy. This brought on a new war; in which Louis, receiving a great defeat from Henry, was obliged to make peace upon such terms as his antagonist thought proper. The tranquillity, however, was but of short duration. Louis renewed his intrigues in favour of William, and endeavoured to form a confederacy against Henry; but the latter found means not only to dissipate this confederacy, but to prevail upon Henry V. emperor of Germany to invade France with the whole strength of the empire on one side, while he prepared to attack it on the other. But Louis having collected an army of 200,000 men, both of them thought proper to desist. Upon this the king of France would have marched into Normandy, in order to put William in possession of that duchy. His great vassals, however, told him they would do no such thing; that they had assembled in order to defend the territories of France from the invasion of a foreign prince, and not to enlarge his power by destroying that balance which arose from the king of England's possession of Normandy, and which they reckoned necessary for their own safety. This was followed by a peace with Henry; which, as both monarchs had now seen the extent of each other's power, was made on pretty equal terms, and kept during the life of Louis, who died in 1137, leaving the kingdom to his son Louis VII.

The young king was not endowed with any of those qualities which constitute a great monarch. 43 Louis VII. a weak prince. From the superstition common to the age in which he lived, he undertook an expedition into the Holy Land, from whence he returned without glory. In this expedition he took his queen Eleanor along with him; but was so much offended with her gallantries during her stay there, as well as her behaviour afterwards, that he divorced her, and returned the duchy of Guienne which he received with her as a portion. Six weeks after this she married Henry duke of Normandy, count of Anjou and Maine, and heir apparent to the crown of England. This marriage was a very great mortification to Louis; and procured him the surname of *the Young*, on account of the folly of his conduct. When Henry ascended the throne of England, some wars were carried on between him and Louis, with little advantage on either side: at last, however, a perfect reconciliation took place; and Louis took a voyage to England, in order to visit the shrine of St Thomas of Canterbury. On his return he was struck with an apoplexy; and though he recovered for that time, yet he continued ever after paralytic on the right side. After having languished for about a year under this malady, he died on the 18th of September 1180, leaving the kingdom to his son Philip.

This prince, surnamed *The Gift of God*, *The Magnanimous*, and *The Conqueror*, during his lifetime; and, as 44 Philip the Great. if all these titles had fallen short of his merit, styled *Augustus* after his death,—is reckoned one of the greatest princes that ever sat on the throne of France, or any other. It doth not, however, appear, that these titles were altogether well founded. In the beginning of his reign he was opposed by a strong faction excited by his mother. This indeed he suppresed with a vigour and spirit which did him honour; but his taking part with the children of Henry II. of England in their unnatural contests with their father, and his treacherous combination with John to seize his brother's kingdom when he was detained in prison by the emperor of Germany, must be indelible stains in his character, and for ever exclude him from the title of *Magnanimous.* As to military skill and personal valour, he was evidently inferior to Richard I. of England; nor can his recovering of the provinces held by the English in France, from such a mean and dastardly prince as King John, entitle him with any justice to the surname of *Conqueror*. In politics he was evidently the dupe of the pope, who made use of him to intimidate John into a submission, by promising him the kingdom of England, which he never meant that he should enjoy. An account of these transactions, which are the principal ones of this reign, is given under the article ENGLAND, N° 121—141.

45 Reign of Louis IX.

Philip died in 1223, and was succeeded by his son Louis VIII. and he, in 1226, by Louis IX. afterwards styled *St Louis*. This prince was certainly possessed of many good qualities, but deeply tinctured with the superstition of the times. This induced him to engage in two croisades. The first was against the Saracens in Egypt: in which he was taken prisoner by the Infidels, and treated with great cruelty; but at last obtained his ransom, on condition of paying a million of pieces of gold, and surrendering the city of Damietta. He no sooner regained his liberty, than he entered Syria with a view of doing something worthy of his rank and character. From this expedition he was obliged to return sooner than he intended, by the news of the decease of his mother Queen Blanch, whom he had appointed regent in his absence, and who had managed the national affairs with the greatest prudence. The king, however, found many disorders in the kingdom upon his return; and these he set himself to reform with the utmost diligence. Having succeeded in this, he yielded to Henry III. of England, the Limousin, Querci, Perigord, and some other places; in consideration of Henry and his son Prince Edward their renouncing, in the fullest manner, all pretensions to Normandy and the other provinces of France which the English had formerly possessed.

The reputation of this monarch for candour and justice was so great, that the barons of England, as well as King Henry III. consented to make him umpire of the differences which subsisted between them. But though he decided this matter very justly, his decision was not productive of any good effect. At last the king, having settled every thing relating to his kingdom in a proper manner, set out on another croisade for Africa; where he died of the plague, on the 25th of August 1270.

46 Philip the Hardy.

Notwithstanding the misfortunes of Louis, his successor Philip, surnamed *the Hardy*, continued the war against the Infidels with great vigour. Being reinforced by his uncle Charles king of Sicily, he brought the war to a more fortunate conclusion than his predecessor had been likely to do. The Saracens were defeated in two engagements, and the king of Tunis obliged to sue for peace; offering at the same time to double the tribute he formerly paid to the crown of Sicily; to reimburse the expences of the war; and to permit the Christian religion to be freely propagated throughout his dominions. Having accomplished this, the two princes set sail for Europe; but the seeds of the distemper which had infected the army in Africa not being eradicated, broke forth on their arrival in Sicily, and raged for some time with great violence. Besides a vast number of common people, the king's brother John, his queen Isabella, with his brother and sister-in-law the king and queen of Navarre, and his uncle and aunt the count and countess of Poictiers, perished by this dreadful malady.

On his return to France, Philip took possession of the counties of Provence and Thoulouse; married his second son, though then very young, to the only daughter of the king of Navarre; while he himself espoused Mary the daughter of the duke of Brabant, reckoned one of the most beautiful princesses of the age. He steadily enforced the regulations of his predecessor, who had prohibited the barons from making private wars upon one another; procured the friendship of Edward I. of England by ceding to him the county of Agenois; and entered into a war with Spain in order to support the pretensions of his nephews, the Infants de la Cerda, to the throne of Castile.

The events of this war were of no great importance; and the king's attention was quickly called off from them by the death of his eldest son Louis at the age of twelve years. This disastrous event happened in the year 1275, not without a suspicion of poison; and the young queen, Mary, was accused by a surgeon named La Brosse as guilty of his death. Philip gave some credit to the accusation: but having applied to a nun, who pretended to be inspired, for full satisfaction, her answer proved fatal to La Brosse. The queen being cleared by this pretended prophetess, La Brosse was accused of a treasonable correspondence with the king of Castile, and condemned to death. The manner of his trial and execution, however, were such, that the tide of popular favour was turned; La Brosse was by the voice of the people declared to be innocent, and the king and queen themselves loudly condemned. During these unfavourable circumstances, the Sicilians, over whom Charles of Anjou had established his authority, instigated by John of Procida, a noble exile, came to a resolution of freeing themselves at once from the French yoke by a general massacre. This cruel

47 French massacred in Sicily.

resolution was accordingly put in execution; and the French, to the number of 8000, murdered in one night; after which Peter of Arragon, sailed to the island, where he was received by the inhabitants as their king and saviour. Charles was sensibly affected by this misfortune: and having laid siege to Messina, sailed directly to Marseilles, where he obtained a powerful reinforcement. But during his absence on this occasion, his son, to whom he had entrusted the care of the siege, having rashly ventured an engagement with the Spanish fleet, was entirely defeated and taken prisoner; which so much affected the father that he died of grief, and Sicily was inseparably attached to the house of Arragon.

The misfortunes of Charles were followed by others equally great to Philip himself. Pope Martin IV. in the warmth of his zeal for the cause of the duke of Anjou, had excommunicated Pedro king of Arragon, and bestowed his kingdom on Charles of Valois, a younger son of the king of France. In attempting to defend himself against the execution of this unjust sentence, Pedro was mortally wounded; but, soon after, the French fleet being defeated by that of Arragon, the king was so much affected by the misfortune that he fell sick. His disease was augmented by the heat

heat of the climate and the fatigues of war; so that, quite worn out with grief and infirmities, he expired at Perpignan in the 41st year of his age, and 16th of his reign.

48 Reign of Philip the Fair.

By the death of Philip the Hardy the French crown devolved on his second son, called also Philip, and from the beauty of his person surnamed *the Fair;* who had espoused the princess of Navarre, and at the time of his accession was in his 17th year. By the marriage with this princess he had obtained the counties of Champagne and Brie; yet with all this increase of power he found himself unable to support the war in which his predecessor had engaged. For this reason he thought proper to abandon the interest of the Infants de la Cerda, and settle the differences with Castile. The treaty was concluded by the mediation of Edward I. of England; at whose intercession Charles the Lame, son to the duke of Anjou already mentioned, was released from his captivity; Edward himself paying part of his ransom. On this Charles consented to renounce his claim on Sicily; and Philip himself promised that his kinsman Philip of Valois should renounce all pretensions to the crown of Arragon. In return for this generosity, the latter obtained the eldest daughter of Charles, with the territories of Anjou and Maine as a dowry.

The tranquillity procured by this treaty, however, was soon interrupted by differences with Edward the promoter of it; Pope Boniface VIII. and Guy de Dampier, count of Flanders. The difference with England took place by a mere accident. A Norman and an English vessel having met off the coast of Bayonne, and having both occasion for water, the crews met and quarrelled at the same spring. A Norman was killed in the squabble by his own weapon, with which he assaulted an Englishman, as the latter pretended: but however the matter was, complaints were made by the Normans to Philip; who, without giving himself much trouble to inquire into the merits of the cause, instantly allowed them to redress their supposed injuries. On this a kind of piratical war commenced between the two nations, in which the two sovereigns for some time took no active part; though other nations interfered; the Irish and Dutch seamen siding with the English, and those of Flanders and Genoa with the French. Thus the powers on both sides were gradually augmented, till at last the affair became so serious, that in one engagement 15,000 French are said to have perished. Philip, alarmed at such a carnage, summoned the king of England as his vassal to attend; and, on his refusal, declared his estates in France to be forfeited. After a number of negotiations, Philip declared that he would be satisfied with the nominal cession of the province of Guienne, which he engaged instantly to restore to the king of England as soon as it should be put into his hands. Edward complied with his demands; but no sooner had the French monarch obtained possession of that country, than he persisted in the forfeiture of the English possessions in France; which treacherous proceeding instantly produced a war betwixt the two nations. Edward, that he might defend himself the better against such a formidable adversary, concluded a treaty with the emperor Adolphus, together with the counts of Brittany, Holland, Bar, Juliers, Gueldres, and Flanders; while Philip strengthened himself by an alliance with John Baliol of Scotland; and thus laid the foundation of that strict union which took place between France and Scotland for two centuries. During this war the French made a descent on the coast of England, and destroyed the town of Dover; while Edward, in revenge, landed in Gascony with an army of 50,000 men. No great exploits, however, were performed with this mighty armament; and both parties finding themselves pretty equally matched, consented to a suspension of arms for two years; during which a peace was finally concluded by the mediation of Pope Boniface VIII. Guienne was restored: Edward espoused Margaret the sister of Philip; while his daughter Isabella was given in marriage to the prince of Wales.

49 Difference with England.

50 Peace concluded.

Both Philip and Edward behaved to the allies whom they had engaged in their cause with equal perfidy. Baliol was abandoned by Philip to the resentment of Edward; while Guy, earl of Flanders, was left equally exposed to the resentment of Philip.

51 Difference with Pope Boniface.

The reconciliation betwixt the French and English monarchs was soon followed by a difference with Pope Boniface, whom they had appointed mediator between them. Sensible of his assuming disposition, however, they had inserted in the reference made to him, that he was chosen as a private man, and not as the successor of St Peter. The haughty pontiff, however, soon showed, that he was not by any means to be treated as a private person, and a contest with Philip quickly ensued. Boniface began with forbidding the clergy to grant the king any subsidies without first obtaining the consent of the Holy See, under the pain of excommunication. Philip revenged himself by prohibiting any ecclesiastics from sending money out of the kingdom without his leave; and by protecting the Colonnas, who were the implacable enemies of Boniface. By this his holiness was so much irritated that he sent a most abusive letter to Philip; after which he summoned the clergy of France to a council at Rome; which Philip retaliated, by seizing the temporalities of those who obeyed the summons, and recalling his brother Charles of Valois, who had the title of the *Pope's General.* Sensible, however, of the danger that attended this contest, he despatched two emissaries, under pretence of conciliating the differences, to levy such a body of troops as might execute his hostile purposes against the holy father. With these he suddenly invested the pope in his native city of Anegnia; and while the bull was preparing for the excommunication of Philip, and releasing his subjects from their obedience, the pope himself was obliged to surrender prisoner to the troops of the prince whom he designed to anathematize.

Though Boniface had been at this time delivered up to the troops of Philip through the treachery of the people of Anegnia, yet he was no sooner taken prisoner and brought to distress, than they rescued him from his guards and conveyed him to Rome, where he soon after died of grief and shame. His successor Benedict revoked the excommunication of Boniface, and attempted to regain the allegiance of Philip by gentle means: but, before this could be effected, he himself was cut off by death, not without strong suspicions of poison. After his decease Philip offered to procure the

52 Death of Boniface.

France.

the papal chair for Bertrand archbishop of Bourdeaux, provided he would condemn the memory of Boniface, restore the honours and estates of the Colonnas which had been forfeited, allow him, for five years, the tenths of the clergy of France, and comply with a request which at that time it was not proper to divulge.

Bertrand having complied with the terms proposed by the king, ascended the papal throne by the name of *Clement V.* but narrowly escaped being killed on his return from the cathedral of Lyons, by the falling of a wall which had been overloaded by the number of people who came to see the procession; by which accident the duke of Brittany was killed, and the king and count of Valois considerably bruised. The new pope fixed his residence at Avignon, where he punctually complied with all the conditions of the treaty, except that of condemning the conduct of Boniface, which he absolutely refused to do; and, instead of doing so, vindicated it with much solemnity, after having inquired into the matter, or pretended to do so. The other condition, which Philip had at first concealed, was discovered by the death of the emperor Albert of Austria; after which event he desired Clement to assist him in placing his brother Charles of Valois on the Imperial throne. But his holiness, apprehensive of the danger which might accrue to himself from being surrounded with the powerful relations of Philip, urged the diet to proceed instantly to an election; recommending to them Henry of Luxemburg as a proper person to fill the Imperial throne. In this scheme he succeeded so well, that the election was over before Philip could arrive at Avignon; and the only consolation the French monarch could obtain for his disappointment, was the possession of the city of Lyons, which had hitherto maintained an independency under its archbishop; but was now persuaded to submit to the authority of Philip.

53 The Pope fixes his residence at Avignon.

54 Expedition of Philip against the earl of Flanders.

In the mean time Guy, earl of Flanders, being abandoned by his ally Edward king of England, was obliged to throw himself on the mercy of the French monarch, who had sent his brother Charles of Valois, with a powerful army to invade his dominions. From the latter indeed he had obtained a promise, that if he could not, within a year, compose the differences subsisting between him and Philip, he should be at liberty to retire, and pursue what measures he pleased. But Philip, in order to gratify the resentment which his queen entertained against the captive prince, detained him, with two of his sons, in close confinement, while he himself entering Flanders in triumph, was everywhere received as sovereign of the country; and at his departure appointed John de Chatillon, a relation of the queen, to govern those newly acquired territories.

The new governor took care to repair the fortifications which had been suffered to decay by reason of the assiduous application of the Flemings to trade; but being of a very haughty and tyrannical disposition, and the poverty of the times not allowing his master to keep regular garrisons, an insurrection quickly took place. This would have been effectually quelled by the diligence of the magistrates, had not Chatillon unluckily entered Bruges, and publicly displayed two hogsheads of ropes, which he threatened to employ in the execution of the inhabitants. On this they flew to arms, and massacred 1500 French; Chatillon himself being obliged to escape their fury by swimming over the town ditch. The insurgents, now daily gathering strength, soon amounted to an army of 60,000 men, who laid siege to Courtray. Here they were rashly attacked in their trenches by the count d'Artois, who met with the reward of his temerity, being cut off with 20,000 of his troops. Philip determined on revenge; though the raising another army obliged him to debase the coin of the kingdom. Thus, however, he was enabled to enter Flanders with such a force as would probably have subdued the whole country, had not Edward artfully communicated to the queen of France, as a secret, a feigned correspondence between the French nobility and the court of Rome; by which false intelligence the king was induced to abandon the enterprise without performing any thing worthy of the armament he had fitted out. The war was continued for some time longer; but the attempts of Philip were constantly defeated by the steady valour of the Flemings; and the only recompense Philip obtained for all his trouble and expence was the city of Courtray.

(53) The conquest of the country prevented by Edward III of England.

(54) Expulsion of the knights Templars.

The other remarkable transactions of this reign were the expulsion and confiscation of the estates of the Templars, who at that time enjoyed immense possessions in France. The confiscations took place without any form of trial, and upwards of 50 of them were put to death in a cruel manner. The grand master, with three of his principal officers, were burnt by a slow fire in the presence of the king himself. The whole body of these unfortunate knights had been accused of the most gross and abominable sensualities. The particulars were revealed, or pretended to be so, by two criminals who received their pardon for the discoveries they made; and these discoveries were confirmed by the confession of the Templars themselves. But this confession was afterwards retracted, as being extorted from them by the fear of absolute destruction; and those who suffered, maintained their purity to the last: and on the whole, it was believed that Philip consulted his avarice rather than his justice by this cruel execution. The latter part of his life was embittered by domestic misfortunes. His three daughters-in-law, Margaret daughter of the duke, and Jean and Blanch of the count, of Burgundy, who had married his three sons, Louis, Philip, and Charles, were accused of infidelity to their husbands. After a severe examination, Margaret and Blanch were condemned to perpetual imprisonment; in which situation Margaret was afterwards strangled by order of her husband Louis. Their paramours, Philip and Walter de Launay, two brothers, were flayed alive, and afterwards hung upon a gibbet, with an usher of the chamber, who had been their confidant. The uneasiness of mind which Philip suffered on this account is supposed to have impaired his health, and he died of a consumption in the year 1295, the 47th of his age, and 30th of his reign.

55 Reign of Louis the Boisterous.

On the accession of Louis, surnamed the *Boisterous*, on account of his violent temper, he found his treasury so much exhausted, that he was obliged to delay for some time the ceremony of his coronation with his new queen Clemence, daughter of the king of Hungary. Finding the kingdom otherwise in a very distracted state, he applied himself very diligently to appease the discontents of his subjects, and conciliate their affection by

France.

by every means in his power. In this he was assisted by his uncle Charles of Valois, on whom he at length entirely devolved the government of the kingdom. This regent, however, behaved with such cruelty as is supposed to have proved fatal to the king himself; for having put to death a nobleman named *Enguerrand de Poitier de Marigni*, who enjoyed the confidence of the late king, this cruelty was so much resented, that his friends were thought to have administered poison to the king; who expired suddenly after drinking a glass of cold water, in the 26th year of his age, and second of his reign. Immediately after his death, Charles prepared to dispute the sovereignty with the brothers of the late sovereign. Philip count of Poictou, the eldest brother, was at that time at Rome assisting in the election of a new pope; and it was not until a month after the death of his brother that he was able to put an end to the intrigues which took place on that occasion: but on his arrival in France, the throne was assigned to him by the unanimous voice of the people. His prospects, however, were for a short time clouded by the queen dowager Clemence being delivered of a son, who has been enrolled among the kings of France under the name of *John I.* His death in three weeks secured the throne to Philip; who, on account of the tallness of his stature, was surnamed the *Long*. His conduct proved superior to that of his predecessor, who had unsuccessfully attempted to subdue the Flemings, and had even suffered himself to be duped by their count; but Philip, by his vigorous behaviour, so reduced them, that they compelled their sovereign to consent to a peace upon honourable terms. He summoned Edward II. of England to do homage for his possessions in France; but that monarch, finding himself involved in difficulties, which rendered the visit inconvenient, sent excuses to Philip, which he was pleased to accept. As the French monarch had formerly taken the cross during the lifetime of his father, he now proposed to put his vow in execution; but was dissuaded from this by the pope himself, at whose instance he sent an army into Italy to put an end to the contending factions of the Guelphs and Gibbelines, who for so long time filled the country with blood and slaughter. The event proved unfortunate; and the disgrace was rendered more mortifying by a contagious distemper, which swept off many thousands of French subjects. This was supposed by the superstitious people of those times to be occasioned by the Jews, who had conspired with the Saracens to poison the springs; and that the execution of the project was committed to some lepers who lived by themselves in hospitals richly endowed. On this a persecution was instantly commenced against these unfortunate men, and great numbers of them were burnt alive; while the Jews in general were abandoned to the rage of the populace, who insulted their persons, and plundered their houses without remorse.

56 Reign of Philip the Long.

Unfortunate expedition into Italy.

The remaining part of the reign of Philip was spent in attempting to regulate the internal concerns of his kingdom. A design had been formed by his predecessors of establishing a certain standard for the coin, weights, and measures, throughout France: and this was adopted by Philip; who, in order to carry it more effectually into execution, purchased from the counts of Valois, Clermont, and Bourbon, their right of coinage within their own dominions. But notwithstanding all his endeavours for this purpose, he never could bring the scheme to bear: nor indeed could he in any degree conciliate the affection of his subjects. He died of a fever and dysentery in the year 1322, the 28th year of his age, and 9th of his reign.

By the death of Philip, the crown of France devolved on his brother Charles IV. who had obtained the surname of *Fair*. After settling some disputes with the duke of Burgundy, his next step was to dissolve his marriage with Blanch, who still continued in prison, and to espouse Mary the daughter of Henry emperor of Germany. This marriage was contracted with a view to the Imperial crown itself, which had been so long separated from that of France; and in 1325 an opportunity offered for Charles to gratify his ambition. At that time the Imperial dignity was disputed between Louis of Bavaria and Frederic of Austria; the latter of whom had been taken prisoner in a battle with Louis. But Pope John, who entertained an implacable hatred against Louis, fulminated the sentence of excommunication against him, intrusting the execution of it to Leopold the brother of Ferdinand. The king of France was induced to embark in the same cause, by a promise of the spoils of Bavaria; while Frederic himself consented to relinquish his pretensions to the empire which he had so unsuccessfully maintained. Louis, however, by instantly releasing his prisoner, and dismissing him in an honourable manner, engaged his friendship, and disarmed his most formidable antagonist. But the pope was not to be disappointed. A considerable sum of money induced Leopold to persevere in his hostilities, while it was determined that a new council of electors should be held in order to transfer the Imperial crown to Charles. In pursuit of this visionary scheme, the king of France set out for the frontiers of Germany with a splendid army; but soon found that there was no possibility of accomplishing his wishes. Leopold alone, from motives of interest, remained his friend; the rest shewed the greatest indifference; and even his brother-in-law the king of Bohemia absented himself from the diet; while in a short time the death of the queen put an end to all connexions with that crown.

58 Reign of Charles the Fair.

On the decease of Mary, Charles espoused Joanna daughter to the count of Evreux: and in order to avert the calamities to be feared from an infant succession, he entered into an alliance with Robert king of Scotland; by which it was provided, that should either of the sovereigns die without an heir apparent, the states of the kingdom should fill the vacant throne, and the survivor of the two kings should with his whole force support the legality of the nomination against any other competitor; though even this proved insufficient to avert the danger which now threatened the kingdom, as shall be explained in the sequel.

Charles died in the year 1328, in the 34th year of his age, leaving his queen pregnant; and as the succession depended on the fruit of the queen's pregnancy, a regent in the mean time was necessary; and two candidates instantly appeared for this important post, urging at the same time their right to the crown as well as to the regency. These were, Philip de Valois, cousin-german to the deceased king; the other, Edward III. king of England, who aspired to the throne in in right of his mother, and the nephew of Charles the Fair. His pretensions, however, were easily set aside, and Philip was confirmed in the regency: from which he soon after stepped into the throne, on the queen being delivered of a daughter; from which circumstance he acquired the surname of *Fortunate*. But though the pretensions of Edward, both to the regency and crown, were unanimously rejected by the people, it was still impossible for Philip to think of the claims of such a formidable rival without uneasiness.

60 Disputes with Edward III. of England.

He therefore summoned the English monarch to do homage for his possessions in France; and, upon his not answering his summons, forfeited them, and seized his revenues. This at last induced Edward to cross the sea and pay his homage; which Philip consented to receive in any form, upon condition of a proper explanation being afterwards given: but as this was studiously delayed after the return of the king of England, the province of Guienne was again seized by the French monarch. Edward, unwilling to lose his continental dominions, or involve himself in a war for the sake of a mere ceremony, sent over a formal deed, by which he acknowledged that he owed liege homage to France. Thus the flame was smothered for the present; and would perhaps have been entirely extinguished, had it not been for the intrigues of Robert of Artois, brother-in-law to the king of France himself, who had been expelled his country, and had taken refuge in England. By him he was persuaded to renew his pretensions to the crown of France, which of necessity produced a war.

For some time, indeed, neither party made any open declaration of hostility; but as both monarchs were possessed of great prudence and sagacity, they soon penetrated each other's designs. Philip, under pretence of taking the cross, began to make prodigious armaments, strengthening himself at the same time by alliances on every side; while Edward, determining to renew his claim to the crown of France, projected the conquest of Scotland. This, however, he could not accomplish; and in the mean time Philip, in order to favour the Scots, with whom he was in alliance, suffered his subjects to make irruptions into Guienne.

61 Edward's first expedition.

In 1337, the war broke out openly. Philip having detached a squadron of his fleet against the Infidels, employed the rest, consisting chiefly of Genoese vessels, against the English. As in this war it was of great importance which side was taken by the Flemings, these people were courted by both parties. Louis count of Flanders declared for Philip, but his subjects were more inclined to King Edward. James Arteville a brewer, the most able and artful man in the country, governed them at that time as much as if he had been their prince; and the advantages arising from the English commerce determining him in favour of Edward, that prince, at his request, embarked for Sluys with a numerous army. Here he arrived in 1338; and on his first landing, it was resolved that the German princes in alliance with him should act against France. But for this a pretence was wanting. The vassals of the empire could not act by Edward's orders, or even as his allies, without directions from the emperor, and he was in league with France. This difficulty, however, was soon overcome: the French had made themselves masters of Cambray, and the emperor resolved that it should be retaken. With this view he created Edward *Vicar General of the Empire*; an empty title, but which seemed to give him a right of commanding the services of the princes of Germany. The Flemings, who were vassals of France, likewise pretended scruples at invading the territories of their liege lord. To quiet these, Edward, by the advice of Arteville, assumed the title of *King of France;* and by virtue of this right challenged their assistance for dethroning Philip de Valois, the usurper of his kingdom. This step, which he feared would beget endless animosities and jealousies, he did not take without hesitation; and, according to Mr Hume, from this time we may date the commencement of that great animosity which the English have always borne to the French.

Edward's first attempt was upon the city of Cambray, to which he laid siege; but in a short time he was prevailed upon by Robert d'Artois to raise the siege and march into Picardy. This country he entered with an army of near 50,000 men, composed mostly of foreigners. Philip came within sight of him with an army of near 100,000, composed chiefly of native subjects; and it was daily expected that a battle would ensue. But the English monarch was averse to engage against so great a superiority: and Philip thought it sufficient if he eluded the attacks of his enemy, without running any unnecessary hazard. The two armies faced each other for several days; mutual defiances were sent; and Edward at last retired into Flanders, and dispersed his army.

Such was the fruitless and almost ridiculous conclusion of Edward's first expedition, which had plunged him into the greatest difficulties. He had contracted near 300,000l. of debt; he had anticipated all his revenue; he had pawned every thing of value which belonged either to himself or his queen; nay, he was obliged in some measure even to pawn himself to his creditors, by desiring their permission to go over to England in order to procure supply, and by promising on his word of honour to return in person if he did not remit their money. On his arrival in England, however, he procured a large supply, sufficient to enable him to make all the necessary preparations for a new invasion; and so certain were the English that France would now be conquered, that the parliament, before Edward's departure, protested that they owed him no obedience as king of France, but that the two kingdoms must remain for ever distinct and independent.

62 His second expedition.

The king of England set out on his second expedition with a fleet of 240 vessels. Philip had prepared a fleet of 400 vessels, manned with 40,000 men; which he stationed off Sluys, in order to intercept him in his passage. The two fleets met on the 13th of June 1340; but the English, either by the superior abilities of Edward, or the greater dexterity of his seamen, gained the wind of the enemy, and had the sun in their backs; and with these advantages began the action. The battle was fierce and bloody: The English archers, whose force and address were now much celebrated, galled the French on their approach; and when the ships grappled together, the example of the king and the nobility who were with him so animated the seamen and soldiers, that they maintained everywhere a superiority over the enemy. The Flemings observing the battle, hurried out of their ports, and brought

63 The French entirely defeated at sea.

France. brought a reinforcement to the English; which coming unexpectedly, had a greater effect than in proportion to its power and numbers. Two hundred and thirty ships were taken: and 30,000 Frenchmen were killed, with two of their admirals: the loss of the English was inconsiderable, compared to the greatness and importance of the victory. None of Philip's courtiers, it is said, dared to inform him of the event; till his fool or jester gave him a hint, by which he discovered the loss he had sustained.

After this great victory, Edward landed his forces and laid siege to Tournay. Philip marched to its relief with a very numerons army: but acted with so much caution, that Edward found himself in a manner blocked up in his camp: and the countess dowager of Hainault, sister to Philip, mother-in-law to Edward, and sister-in-law to Robert d'Artois, coming out of a convent, to which she had retired, interposed with so much spirit and address, that she engaged all parties to agree to a truce for a year, and might perhaps have brought about a peace if she had survived.

64 Edward invited into France a third time.

In 1341, however, Edward's ambition was once more excited by the invitation of the count de Mountfort, who had possessed himself of the province of Brittany, and applied to Edward to second his claims. An offer of this kind entirely coincided with Edward's most sanguine desires. He was happy in the promised assistance of Mountfort, an active and valiant prince, closely united to him by interest, and thus opening to him an entrance into the heart of France. These flattering prospects, however, were for a while damped by the imprisonment of Mountfort; whose aims being discovered, he was besieged in the city of Nantz and taken. But Jane of Flanders his wife soon made up for the loss of her husband. This lady courageously undertook to support the falling fortunes of her family. She assembled the inhabitants of Rennes, where she then resided; and carrying her infant son in her arms, deplored her misfortunes, and attempted to inspire the citizens with an affection for her cause. The inhabitants of Nantz instantly espoused her interests, and all the other fortresses of Brittany embraced the same resolution. The king of England was apprised of her efforts; and was entreated to send her succours with all possible expedition to the town of Hennebone, in which place she resolved to sustain the attacks of the enemy. Charles de Blois, Philip's general, anxious to make himself master of so important a fortress as Hennebone, and still more to take the countess a prisoner, sat down before the place with a large army, and conducted the siege with indefatigable industry. The defence was no less vigorous: several sallies were made by the garrison, in which the countess herself was still the most active, and led on the assault. Observing one day that their whole army had quitted the camp to join in a general storm, she sallied out by a postern at the head of 300 horse, set fire to the enemies tents and baggage, put their sutlers and servants to the sword, and occasioned such an alarm, that the French desisted from the assault, in order to cut off her communication with the town. Thus intercepted, she retired to Auray, where she continued five or six days; then returning at the head of 500 horse, she fought her way through one quarter of the French camp, and returned to her faithful citizens in triumph. But the besiegers had at length made several breaches in the walls; and it was apprehended that a general assault, which was hourly expected, would be fatal. A capitulation was therefore proposed, and a conference was already begun, when the countess, who had mounted on a high tower, and was looking towards the sea with great impatience, descried some ships at a distance. She immediately exclaimed that succours were arrived, and forbade any further capitulation. She was not disappointed in her wishes; the fleet she discerned carried a body of English gentlemen, with 6000 archers, whom Edward had prepared for the relief of Hennebone, but who had been long detained by contrary winds. They entered the harbour under the conduct of Sir Walter Manny, one of the most valiant commanders of his time. This relief served to keep up the declining spirits of the Bretons until the time appointed by the late truce with Edward was expired, on which he was at liberty to renew the war in greater form.

The succours under Sir Walter Manny were quickly followed by a more considerable reinforcement commanded by Robert of Artois, who made himself master of the city of Vannes soon after his arrival: but the French soon recovered the city, and Robert was compelled to relinquish his prize after receiving a mortal wound. Edward himself, eager to revenge the death of his ally, soon landed at Morbian near Vannes with an army of 12,000 men. With this small number he undertook at once the siege of Vannes, Nantz, and Rennes: but by dividing his forces, he failed in every enterprise, and gave an opportunity to John duke of Normandy, the king of France's eldest son, to invest him in his camp. In this situation his provisions soon began to fail; and Edward, notwithstanding all his valour, would have been obliged to surrender, had he not, by a train of artful negotiations, induced Philip to relinquish the advantage he had obtained, and consent to a truce of three years. This was accomplished by the mediation of the court of Rome; and the French monarch was soon made sensible of the partiality of that court, and the imprudence of the step he himself had taken. Edward soon found a pretence to renew the war, from the execution of some nobles of Brittany, who, he said, were partisans of Mountfort, and chose to look upon their punishment as an infraction of the treaty.

Philip now endeavoured to secure himself against the power of his rival by alliances, and by purchasing the city of Montpelier from the king of Majorca: but in the mean time, the English, under the command of the earl of Derby, had invaded Guienne, twice defeated the French army commanded by the count de Lisle, and made themselves masters of a great number of towns. Philip, by reason of the exhausted state of his treasury, was for some time incapable of making any opposition. To recruit his finances, he was obliged to lay a duty on salt; which gave such offence to his subjects as had almost excited a rebellion. When these discontents were assuaged, however, he soon raised an army of 100,000 men, whose courage was further raised by the presence of the dukes of Normandy and Burgundy. The English general was therefore compelled to stand upon the defensive. One fortress after another was surrendered to the French; till at length nothing appeared but the total extinction of the power of of England upon the continent. In this situation, Edward resolved to bring relief in person to his distressed subjects and allies; and accordingly embarked in 1346 at Southampton, on board a fleet of near 1000 sail, of all dimensions. He carried with him, besides all the chief nobility of England, his eldest son the prince of Wales (afterwards surnamed the *Black Prince*), a youth of about 15 years old, and already remarkable both for understanding and valour above his age. His army consisted of 4000 men at arms, 10,000 archers, 10,000 Welsh infantry, and 6000 Irish; all which he landed safely at La Hogue, a port in Normandy, which country he determined to make the seat of the war.

65 He lands with an army in Normandy.

The intelligence of Edward's landing, and the devastation caused by his troops, who dispersed themselves over the whole face of the country, soon spread universal consternation through the French court. The rich city of Caen was taken and plundered by the English without mercy; the villages and towns, even up to Paris, shared the same fate; and the French had no other resonrce but by breaking down their bridges, to attempt putting a stop to the invader's career. In the mean time, Philip was not idle in making preparations to repress the enemy. He had stationed one of his generals, Godemar de Faye, with an army on the opposite side of the river Somme, over which Edward was to pass; while he himself, at the head of 120,000 fighting men, advanced to give the English battle. Edward, thus unexpectedly exposed to the danger of being enclosed and starved in an enemy's country, published a reward to any that should bring him intelligence of a passage over the river Somme. This was discovered by a peasant of the country, named Gobin Agace: and Edward had just time to get his whole army over the river, when Philip appeared in his rear. Of the battle that ensued, in which the French were overthrown with great slaughter, an account is given under the article CRESSY.

66 Calais taken.

Edward next laid siege to Calais, which was then defended by John de Vienne, an experienced commander, and supplied with every thing necessary for defence. It was at length taken, after a twelvemonth's siege, the defendants having been reduced to the last extremity by famine and fatigue: for the consequences of which, see the article CALAIS.

From the very beginning of this unfortunate war, Philip had invariably showed himself desirous of peace, and the victory of Cressy rendered him still more so. Edward also, notwithstanding his successes, was unable to support the expences of the war any longer. The mediation of the court of Rome was therefore readily accepted, and a truce for three years concluded. At the same time, Philip met with some recompense for the losses he had sustained, by the acquisition of Dauphiny, which has ever since given the title of *Dauphin* to the eldest son of the king of France. It was obtained by the resignation of Hubert prince of Dauphiny; who, being disappointed in his hopes of marrying Joan, daughter of the duke of Bourbon, gave up his territories to Charles the grandson of Philip, who had married that lady; himself retiring into a convent. Soon after this event, the king himself, who had been some time a widower, was married to Blanch, the daughter of Philip count of Evreux, and Jane queen of Navarre; and his son John to the countess of Boulogne. But the happiness occasioned by these marriages was soon interrupted by the death of the king; who expired in the year 1350, the 57th of his age, and 23d of his reign.

67 Death of King Philip.

On the death of Philip his eldest son John took possession of the kingdom; but scarcely was he seated on the throne, when he disgusted his nobility by an unseasonable act of severity. Robert de Brienne, count of Eu and Guisnes, had been taken prisoner by the king of England at Caen; and under pretence of negotiating his ransom, had passed several times between France and England; but being accused of a treasonable correspondence with Edward, he was by order of his sovereign suddenly arrested, condemned, and beheaded, without any form of trial. At his death, it is said that he confessed his treasonable practices; but that has not been authenticated by any historian of credit. Having been constable of France, the sword, the badge of his office, was delivered to Charles de la Carda: but his fate was equally unfortunate with that of his predecessor, being soon after assassinated by Charles king of Navarre, surnamed *The wicked*. This prince, celebrated for his personal qualifications, but detested for his crimes, was the son-in-law of John himself. He had demanded the duchy of Angouleme of the king: but as the latter had thought proper to bestow it upon Carda, he had taken the effectual method of revenging himself, by assassinating his rival. John did not fail to show a proper resentment; but such was the weakness of his government, that the king of Navarre set him at defiance, and would not even condescend to the ceremony of asking pardon until John had sent him his second son as an hostage for his personal security. To these offences the king of Navarre added another still more atrocious, viz. that of aspiring to the crown of France itself; to which he pretended a right derived from his mother, being grandson by the female side to Louis the Boisterous. But his more immediate demands were the countries of Champagne and Brie. To obviate all difficulties on this head, however, John bestowed the duchy of Normandy on his eldest son Charles; and commanded him to seize the estates of the king of Navarre. On this the latter soon made his appearance at Paris; but John fonnd himself obliged to appease his murmurs at the expence of no less than 100,000 crowns.

68 Infamous conduct of the king of Navarre.

All this time the truce with England had been very ill observed on both sides; the French had possessed themselves of the port of St Jean d'Angeli; and the English had surprised the town of Guisnes. The rival houses of Mountfort and Blois still continued their animosities; while Edward continued to threaten war. The king of Navarre went on with his intrigues; and even the dauphin was drawn into a confederacy against his father. John, however, being informed of their machinations, found means to defeat them effectually. The dauphin was reclaimed by pointing out to him the impropriety of his conduct, and the disadvantage which must unavoidably accrue to himself from the connexions which he had formed. The king of Navarre was invited with his principal adherents, to an entertainment, where they were unexpectedly arrested: the former being sent prisoner to Chateau Gaillard, and several of the most obnoxious of the latter put to death. The rest of the conspirators, instead

69 He is taken and confined.

France. instead of being dismayed by this check, immediately showed themselves in open rebellion; and finding themselves unable, without farther assistance, to gain their point, they without delay invited over Edward from England.

70 France again invaded by Edward.

That warlike and enterprising monarch had never lost sight of the object he had originally embraced; and on the expiration of the truce had sent his son, the prince of Wales, from the colour of his armour surnamed the *Black Prince*, with a fleet towards the coast of France. Young Edward had with this fleet entered the mouth of the river Garonne, burnt the towns and villages of Languedoc, and retired with the plunder into the country of Guienne. Edward himself, who had likewise passed over to the continent, wasted the country as far as St Omer; but the French king, notwithstanding all these provocations, determined to avoid a battle, and therefore prohibited his general, the constable of Bourbon, from coming to an engagement, though his army was much superior to that of the prince of Wales. With the flower of his troops, however, he pursued Edward from St Omer to Hesdin, where he defied him to a pitched battle; but the latter, without minding his bravadoes, continued his march to Calais, from whence he embarked for England. After his departure, John called an assembly of the states at Paris, where he explained the distressed situation of his finances, and showed so fully the necessity of assisting him in the defence of the kingdom, that they consented to maintain an army of 30,000 men during the war. To supply the other exigencies of government, they revived the duty on salt, and added a variety of other imposts; but at the same time appointed a committee of their own number to take care that the money was solely appropriated to the public service.

The satisfaction which John received from these grants, and the suppression of some disturbances which happened about this time, was soon overcast by the news that the prince of Wales had marched with an army of 12,000 men from Bourdeaux: and, after ravaging the Agenois, Quercy, and the Limousin, had entered the province of Berry. The young warrior had penetrated into the heart of France with this trifling body of forces, in hopes of joining the duke of Lancaster in Guienne. But he soon found that his scheme was impracticable: the country before him was too well guarded to permit his advancing further; and all the bridges behind were broken down, which effectually barred a retreat. In this embarrassing situation, his perplexity was increased, by being informed, that the king of France was actually marching at the head of 60,000 men to intercept him. He at first thought of retreating: but soon finding it impossible, he determined calmly to wait the approach of the enemy; and, notwithstanding the disparity of forces, to commit all to the hazard of a battle.

Battle of Poictiers.

It was at a place called *Maupertuis*, near Poictiers, that both armies came in sight of each other. The French king might very easily have starved the English into any terms he thought proper to impose; but such was the impatient valour of the French nobility, and such their certainty of success, that it might have been equally fatal to attempt repressing their ardour to engage. In the mean time, while both armies were drawn out, and expecting the signal to begin, they were stopped by the appearance of the cardinal of Perigord, who attempted to be a mediator between them. However, John, who made himself sure of victory, would listen to no other terms than the restitution of Calais; with which the Black Prince refusing to comply, the onset was deferred till the next morning, for which both sides waited in anxious suspense.

During this interval, the young prince strengthened his post by new intrenchments; and placed 300 men in ambush, with as many archers, who were commanded to attack the enemy in flank during the heat of the engagement. Having taken these precautions, he ranged his army in three divisions; the van was commanded by the earl of Warwick, the rear by the earls of Salisbury and Suffolk, and the main body by himself. In like manner, the king of France arranged his forces in three divisions; the first commanded by the duke of Orleans; the second by the dauphin, attended by his younger brothers; while he himself led up the main body, seconded by his youngest and favourite son, then about 14 years of age. As the English were to be attacked only by marching up a long narrow lane, the French suffered greatly from their archers, who were posted on each side behind the hedges. Nor were they in a better situation upon emerging from this danger, being met by the Black Prince himself, at the head of a chosen body of troops, who made a furious onset upon their forces, already in great disorder. A dreadful overthrow ensued: those who were as yet in the lane recoiled upon their own forces; while the English troops who had been placed in ambush, took that opportunity to increase the confusion, and confirm the victory. The dauphin and the duke of Orleans were among the first that fled. The king of France himself made the utmost efforts to retrieve by his valour what his rashness had forfeited; but his single courage was unable to stop that consternation which had now become general through his army; and his cavalry soon flying, he found himself exposed to the enemy's fury. At length, spent with fatigue and despairing of success, he thought of yielding himself a prisoner; and frequently cried out, that he was ready to deliver himself to his cousin the prince of Wales. The honour of taking him, however, was reserved for a much more ignoble hand; he was seized by Dennis de Morbec, a knight of Arras, who had been obliged to fly his country for murder.

72 French defeated.

73 King John taken prisoner.

In April following, the prince conducted his royal prisoner through London, attended by an infinite concourse of people of all ranks and stations. His modesty upon this occasion was very remarkable: the king of France was clad in royal apparel, and mounted on a white steed distinguished by its size and beauty: while the prince himself rode by his side upon a mean little horse, and in very plain attire.

74 Miserable situation of France.

This dreadful defeat, which happened in the year 1356, almost entirely ruined the French affairs; and the miseries which ensued from this cause were greatly augmented by internal commotions. The dauphin, who had now assumed the government, was altogether unable to govern a turbulent and seditious people at such a crisis. An assembly of the states, which he called, took the opportunity to limit the power of the prince, impeach the former ministers, and demand the liberty

 liberty of the king of Navarre; the treasurer of the crown was murdered by one Marcel, a partizan of that worthless prince who had filled the city of Paris with confusion by his intrigues. The assassin whom Marcel employed was dragged, by order of the dauphin, from an altar where he had taken refuge, and instantly put to death. The bishop of Paris resented the indignity done to the church; and Marcel avenged the fate of his adherent, by murdering both the mareschals who had seized him in the presence of the dauphin; and so near him, that his clothes were stained with their blood. The prince indignantly asked him, if he was to be involved in the same destruction? when Marcel affected to provide for his safety by putting upon him a blue hood, the badge of the adherents of Navarre.

75 The king of Navarre escapes from prison.

The public disorders were now also augmented by the escape of the king of Navarre from confinement; and though the dauphin was even assured that he had administered a dose of poison to him, he was obliged still to pay him some appearance of regard. A scheme was even formed by the chiefs of the sedition to change the government, to vest all the power in the commons, and leave the king no more than an empty title; but though this was favourably received by the city of Paris, it was entirely rejected by the other cities of the kingdom. The dauphin was likewise recognized as regent by the states general, and the inhabitants of Picardy and Champagne took up arms in his cause.

76 Insurrections and tumults of the peasants.

In this disastrous state of affairs, the miseries of the people were heightened by a new and unexpected evil. The peasants, who had been all along oppressed by the nobles, were now treated in such a manner, that they rose in great numbers to revenge themselves; the castles of the nobility were rased to the ground, their wives and daughters ravished, and themselves put to the most cruel torments. At last they were obliged to arm in their own defence. The duke of Orleans cut off 10,000 of them in the neighbourhood of Paris; 12,000 were massacred by the king of Navarre; 9000, who had laid siege to the town of Meaux, where the dauphiness and three other ladies of the first rank resided, were routed and pursued with dreadful slaughter by an officer in the service of Edward. Amidst these confusions, Marcel, the seditious leader already mentioned, perished in a tumult of his own raising; and the most virtuous and prudent people of the nation supported the pretensions of the dauphin. His most dangerous enemy was the king of Navarre, who had allured to his standard numbers of those Norman and English adventurers who had followed Edward into France, and there been left to seek their fortunes; where they associated themselves under the name of the *Companions*.

77 Peace between the dauphin and king of Navarre.

By such a formidable competitor the dauphin was reduced almost to the last extremity, when his hopes were revived by an unexpected proposal from his rival, of peace upon equitable and moderate terms. Historians in general have ascribed this to the natural levity of the king of Navarre; but some have been of opinion that he acted from prudential motives, and that he justly supposed it would be more easy to deal with the dauphin who was his own kinsman, and humbled by so many misfortunes, than with a haughty and imperious conqueror like Edward.

On the expiration of the truce in 1359, Edward again set sail for France, and anchored before Calais with a fleet of 1100 sail, assumed the title of *King of France*, and augmented his army to 100,000 men.

78 A new invasion of France by Edward.

The dauphin, finding himself unable to withstand so great a power, was obliged to act on the defensive; choosing the city of Paris for his station, and allowing the English to ravage all the open country. Thus they were allowed to penetrate through Picardy into Champagne; but the city of Rheims, where Edward designed to have been crowned king of France, baffled their utmost efforts. From Champagne, therefore, which was already laid waste, the English monarch marched into Burgundy; pillaged Tonnere, Gaillon, and Avalon. Burgundy was saved by the payment of 100,000 merks, and a like sum was paid for Nivernois. At last, after a long and destructive march, Edward arrived at the gates of Paris; but the prudence of the dauphin and citizens of that metropolis had rendered it impregnable to the attacks of famine as well as the assaults of an army.

79 He concludes a peace.

Thus the war went on till the year 1360, when the king of England was inclined to peace, as is said, by a dreadful tempest, to which his army was exposed while encamped in the fields round Chartres. His conduct, however, may more reasonably be derived from other motives. Notwithstanding all the victories he had gained, the French nation showed not the least favour to his claim of succession; the king of Navarre was a dangerous rival, and the caution of the dauphin in avoiding an engagement deprived him of the advantages he might expect from his valour and military skill. Thus conferences for a peace were opened at Bretigny in the Chartraine; and it was at last concluded on the following conditions, viz. That King John should pay for his ransom, at different periods, three millions of crowns of gold (about a million and a half of our money): Edward should for ever renounce all claim to the kingdom of France; and should remain possessed of the territories of Poictou, Xaintonge, l'Agenois, Perigord, the Limousin, Quercy, Rouvergne, l'Angoumois, and other districts in that quarter, together with Calais, Guisnes, Montreuil, and the county of Ponthieu on the other side of France. Some other stipulations were made in favour of the allies of England, as a security for the execution of these conditions.

Upon John's return to his dominions, he found himself very ill able to ratify those terms of peace that had been just concluded. He was without finances, at the head of an exhausted state; his soldiers without discipline, and his peasants without subordination. These had risen in great numbers; and one of the chiefs of the banditti assumed the title of *The Friend of God and the terror of Man*. A citizen of Sens, named *John Gouge*, also got himself, by means of his robberies, to be acknowledged king; and he soon caused as many calamities by his devastations, as the real king had brought on by his misfortunes. Such was the state of that wretched kingdom upon the return of its captive monarch: and yet such was his absurdity, that he immediately prepared for a croisade into the Holy Land, before he was well replaced on the throne. Had his exhausted subjects been able to equip him for this chimerical project, it is probable, he would have gone through with it; but their miseries were such, that they were even too poor to pay his ransom. This was a breach of treaty that John would not submit to;

80 John, unable to pay his ransom, returns to England.

and he was heard to express himself in a very noble manner upon the occasion: "Though (says he) good faith should be banished from the rest of the earth, yet she ought still to retain her habitation in the breast of kings." In consequence of this declaration, he actually returned to England once more; and yielded himself a prisoner, since he could not be honourably free. It is said by some, that his passion for the countess of Salisbury was the real cause of his journey: but we want at this time the foundations for such an injurious report. He was lodged in the Savoy, the palace where he had resided during his captivity; and soon after he closed a long and unfortunate reign, by his death, which happened in the year 1384, about the 56th year of his age.

81 His, and is succeeded by Charles the Wise.

Charles, surnamed *the Wise*, succeeded his father on the throne of France; and this monarch, merely by the force of a finely conducted policy, and even though suffering some defeats, restored his country once more to tranquillity and power. He quelled and dissipated a set of banditti, who had associated themselves under the name of *Companions*, and who had long heen a terror to the peaceable inhabitants. He had them enrolled into a body, and led them into the kingdom of Castile against Peter, surnamed *the Cruel*, whom his subjects had dethroned, and who, by means of an alliance with the English, endeavoured to get himself reinstated upon the throne. In consequence of these alliances, the English and French again came to an engagement; their armies on the one side commanded by the Black Prince; on the other, by Henry of Transtamarre, and Bertrand du Guesclin, one of the most consummate generals and accomplished characters of the age in which he lived. However, the usual good fortune of the English prince prevailed; the French lost above 20,000 men, while only four knights and 40 private men on the side of the English were slain.

82 Bad success of the English.

Nevertheless, these victories were attended with very few good effects. The English, by their frequent levies, had been quite exhausted, and were unable to continue an army in the field. Charles, on the other hand, cautiously forebore coming to any decisive engagement; but was contented to let his enemies waste their strength in attempts to plunder a fortified country. When they were retired, he then was sure to sally forth, and possess himself of such places as they were not strong enough to defend. He first fell upon Ponthieu; the citizens of Abbeville opened their gates to him; those of St Valois, Rue, and Crotoy, imitated the example; and the whole country was in a little time reduced to total submission. The southern provinces were, in the same manner, invaded by his generals with equal success; while the Black Prince, destitute of supplies from England, and wasted by a cruel and consumptive disorder, was obliged to return to his native country, leaving his affairs in the south of France in a desperate condition.

In this exigence, the resentment of the king of England was excited to the utmost pitch; and he seemed resolved to take signal vengeance on his enemies of the continent. Bnt the fortunate occasion was now elapsed; and all his succeeding designs were marked with ill success. The earl of Pembroke and his whole army were intercepted at sea, and taken prisoners by Henry king of Castile. Sir Robert Knolles, one of his generals on the continent, at the head of 30,000 men, was defeated by Bertrand du Guesclin; while the duke of Lancaster, at the head of 25,000 men, had the mortification of seeing his troops diminished one half by flying parties, without ever coming to a battle.

At last, the English affairs were totally ruined by the death of the Black Prince and King Edward. On receiving this news, the armies of Charles attacked the English on all sides. One, under the command of the duke of Burgundy, entered Artois; another entered Auvergne, under the command of the duke of Berry; that which acted in Guienne was commanded by the duke of Anjou; and the forces in Bretagne were under the constable Guesclin: the king himself had a powerful body of troops, that he might be able to repair any accident which should happen through the chance of war. The constable joined the duke of Burgundy, who found it difficult to oppose Sir Thomas Felton and the seneschal of Bourdeaux. Soon after his arrival, the constable attacked and defeated them, making both the commanders prisoners of war. This victory was so well pnrsued, that, at the close of the campaign 1377, Bayonne and Bourdeaux, with the districts about them, and the fortress of Calais with its dependencies, were all the places left to England on the continent.

Thus Charles established once more the house of Valois on the throne of France, but did not long live to enjoy his good fortune. He died in the year 1379, at the age of 44, of the consequences of poison formerly given him by the king of Navarre, as has already been mentioned. The immediate operation of this poison had been suspended by the skill of a physician sent by the emperor Charles IV. He opened an issue in his arm, the running of which preserved his life; but the physician declared, that whenever it should dry up, the consequence would be fatal. Not long before his death, Charles had commenced a process against the king of Navarre for this crime. Several of the associates of the latter suffered on this occasion, and the king himself was deprived of his possessions in Normandy, as well as his lordship of Montpelier, which had been given him in lieu of the counties of Champagne and Brie, and the duchy of Burgundy which he had claimed. He did not long survive the death of the French monarch whom he destroyed. His death was singular and very terrible; for having been afflicted with the leprosy, he had been obliged to make use of some bandages dipped in sulphur, and afterwards steeped in brandy. These took fire by the carelessness of a page, and the unfortunate prince was burnt to death.

83 Death of Charles;

84 and of the king of Navarre.

85 Reign of Charles VI.

Charles V. was succeeded by his son Charles VI. surnamed the *Well-beloved*, who, at the time of his accession to the throne, was only 12 years of age. The duke of Anjou, eldest brother to the late king, had been appointed guardian during the minority of the prince; but he being totally unfit for the office, and distinguished only for his rapacity and ambition, readily resigned his charge to the dukes of Burgundy and Bourbon, the former uncle to the king by his father's side, the latter by his mother's. None of these tutors, however, proved faithful to the trust reposed in them. The duke of Anjou seized the plate and treasures of the late

late king, in order to support his ambitious enterprises. At that time Joan, infamous for her profligacy, reigned in Naples. She had appointed one Charles Durazzo, who was her relation, to succeed her in the throne; but the inhuman wretch murdered his benefactress, who with her last breath revoked her grant of the kingdom to him, and bestowed it upon the duke of Anjou. His influence at the French court enabled him to waste the treasures of the kingdom in support of his pretensions; though he proved ultimately unsuccessful, his forces being constantly defeated, and his designs frustrated by the superior skill of his adversary. The duke of Burgundy, instead of instructing his pupil in the ways of virtue, indulged him in every kind of vicious pleasure, hoping thereby to gain his favour afterwards. The citizens of Paris, oppressed by taxes, broke out into tumults, and were quelled with difficulty; while the mal-administration of Philip the duke of Burgundy soon involved the nation

86 Flanders invaded.

in hostilities with the Flemings. Philip invaded their country at the head of an army of 80,000 men, along with whom was the young king, accompanied by the principal nobility of France. The first operations of war were favourable to the Flemings; but they were at length totally defeated on the banks of the river Lis, where their leader, with 25,000 of his followers, perished. This victory was followed by the submission of the whole country; but the satisfaction of the king at this event was disturbed by new seditions and revolts in the city of Paris, and other great towns of the kingdom. His return, however, at the head of a victorious army, soon reduced them to their duty, and several of the revolted cities were severely punished; at the same time that the death of the duke of Anjou having freed him from the immediate dependence on his tutors, he assumed the reins of government into his own hands in the year 1384.

The genius which Charles began to display in his early years, raised the hopes of the nation; but these were soon overcast, and greater misfortunes than ever were now about to ensue. The young king, whose marriage began to be a subject of attention to the council, refused to comply with the forms in use among his predecessors, and insisted upon seeing the

87 Marries Isabella daughter to the duke of Bavaria.

person designed for his consort. An interview was accordingly contrived betwixt him and Isabella daughter to the duke of Bavaria; where he fell in love with that princess, and afterwards married her. His administration was for some time prudent and vigorous. He conciliated the affections of his people by restoring their privileges, punishing their oppressors, and relieving them from the taxes which had been imposed in his minority. He reduced the Flemings to submit to the authority of his uncle the duke of Burgundy; detached 15,000 archers and 1500 men at arms to assist the Scots in their incursions into England; and in 1385 fitted out a prodigious armament against England. A vast fleet was assembled in the harbour of Sluys, and a very numerous army in the neighbourhood. According to some writers, the armament consisted of 1200 ships, 20,000 foot differently armed, 20,000 cavalry, and 20,000 cross-bow-men. There was besides a vast wooden edifice or floating town, which was contrived for the protection of the soldiers when landed: but all these preparations were at last brought to nothing through the obstinacy of the duke of Berry; who, having been originally against this measure, carried on his part of the armament so slowly, that he did not arrive at Sluys till the middle of September, when the season was so far advanced, that no invasion was practicable. A storm that happened soon after, drove the greatest part of the fleet on shore, and beat the wooden edifice all to pieces; the remains of which the king bestowed on the duke of Burgundy, to whom he gave also the port of Sluys, which was then very commodious, and of the utmost importance.

The destruction of the French fleet was only a prelude to calamities of a more extraordinary nature. The Sieur de Craon, a profligate nobleman, had been intrusted by the court of France with a considerable sum of money for the support of the duke of Anjou, at the time he was reduced to distress by his Italian expedition. This money he had dissipated at Venice; but, by the credit of the duke of Orleans, the king's brother, he had obtained his pardon, and returned to court. Here he attempted to gratify his private resentment by the assassination of Oliver Clisson the constable, whom he suspected of having promoted his disgrace. This veteran hero was attacked, on his return from the hotel de St Pol, by a band of 20 ruffians, against whom he defended himself with wonderful intrepidity, when at last he fell, after receiving more than 50 wounds. Happily, however, he recovered notwithstanding his being mangled in this manner; while the assassin, to screen himself from vengeance, fled for protection to the duke of Brittany. The king demanded the assassin to be given up to him in chains; but the duke answered, that he knew nothing of him: to which the king giving no credit, marched with all his forces into his territories. When the army arrived

88 Is seized with lunatic fits.

at Mans, the king was seized with a slow fever; but could not be prevailed upon to rest or take physic. On the 5th of August 1391, having marched all day in the heat of the sun, a miserable, ragged, wild-looking fellow darted from behind a tree, and laying hold of the bridle of his horse, cried out "Stop! where are you going, king? You are betrayed:" and immediately withdrew again into the wood. The king passed on not a little disturbed: and soon after one of the pages, who rode behind and carried his lance, overcome with heat, fell asleep, and let it fall upon the helmet which was carried by the other. The king hearing the noise, looked about; and perceiving the page lifting the lance, killed him immediately: then riding furiously with his sword drawn, he struck on every side of him, and at every person, till he broke his sword: upon which one of his gentlemen leaped up behind him and held his arm. He fell soon after, and lay as if he had been dead; so that being taken up and bound in a waggon, he was carried back to Mans, where he lay two days in a lethargy, after which he came a little to himself, and expressed great concern at the blood he had shed in his delirium. The people, who had expressed the greatest concern for his distemper, were equally rejoiced at the news of his recovery; but unfortunately it was soon discovered, that he no longer possessed that strength of judgment and understanding for which he had formerly been remarkable. Hence a regency became indispensably necessary; and

and the competition for it brought to light the characters of the queen and duke of Orleans, which had not hitherto been displayed to public view. The former of these was a most beautiful and accomplished princess; but vindictive, violent, and intriguing: insensible to natural affection, but easily accessible to flattery, and ready to yield to every impulse of lawless passion. The duke of Orleans was equally remarkable for his personal accomplishments, and had married Valentina daughter of the duke of Milan; but his engagements with that princess did not prevent him from engaging in a number of licentious amours, and among the rest, as was supposed, with his sister-in-law Isabella. During the king's illness he openly aspired at the regency; but his pretensions were overruled by the states, the administration of affairs being for the present conferred on the duke of Burgundy. In a few months indeed the health and understanding of the king seemed to be sufficiently restored: but in the year 1393 it was again disturbed by an accident no less extraordinary than the former had been. An entertainment had been given in honour of the marriage of one of the queen's attendants. At this six masques entered the apartment, disguised like satyrs, in linen clothes covered with rosin, and while warm stuck over with down. These were the king and five of his lords. The duchess of Berri paid attention to the king, though she did not know him, and engaged in conversation with him. In the mean time the duke of Orleans, ignorant of the consequence, out of diversion ran a lighted torch against one of them. His whole dress was instantly in a flame, and the fire was from him communicated to all the rest. The masques, notwithstanding the dreadful situation they were in, called out, "Save the king; save the king!" on which the duchess of Berri, recollecting that it must be him with whom she had engaged in conversation, wrapped him in her cloak, and preserved him from further danger. Only one of the rest escaped by jumping into a cistern of water; the other four perished in the flames. The terror which the king underwent by this accident instantly occasioned a relapse; and he continued delirious at intervals as long as he lived. During this state of insanity he was untractable by every person except Valentina duchess of Orleans; who seemed to have as great an influence over him as her husband the duke had over the mind of the queen. So great was the power indeed which she had over the king in this deplorable state, that in those superstitious times it was supposed by many to be the effect of magic. Others, with more probability, ascribed it to her superior charms as a woman; and this idea instantly produced her a number of enemies among her own sex, the duchess of Burgundy particularly; and the quarrel between the two ladies soon extended itself to their husbands. Amidst their dissensions, however, they did not entirely neglect the administration of public affairs; they strove to conciliate the affection of the parliament by preserving the rights of the commons inviolate; and they endeavoured to check an inordinate passion for gaming which began to appear about this time, and to substitute manly and martial exercises in its place.

89 Disturbances about a regency.

90 An accident occasions a relapse in the king.

During the intervals of his reason, Charles frequently assumed the government into his own hands: and as the war still continued with England, though in a languid manner, the French monarch, in one of these lucid intervals, had an interview with Richard king of England, in order to put an end to hostilities, of which both were equally weary. Still, however, their claims were so difficult to be adjusted, that they could do no more than conclude a truce for 25 years; during which space it was hoped that a lasting peace might take place. Richard gave up Cherburg to Charles, and Brest to the duke of Brittany: a marriage was also concluded betwixt the king of England and Isabella the daughter of Charles, though the latter was then only seven years of age; but by reason of the tender age of the princess, this marriage was never consummated.

91 Interview betwixt the kings of France and England.

During this unfortunate reign, France was still farther weakened by the succours sent to the Hungarians against the Turks. On this fatal expedition upwards of 1000 of the bravest and most experienced knights were sent under the conduct of John count of Nevers, eldest son of the duke of Burgundy; the count of Eu, constable of France; John de Vienne, admiral of France; and the count of Marche, a prince of the blood royal; together with De Courcy, one of the best and most experienced captains in Christendom. The prudent counsels of this veteran, however, were not obeyed by the youthful warriors by whom he was accompanied. Attacking the enemy therefore rashly, and while heated with wine, they were all either killed or taken prisoners. Notwithstanding this disaster, however, assistance was sent in the year 1400 to Wenceslaus emperor of Germany; and the duke of Orleans, who commanded the army on this occasion, acquitted himself so well that he acquired the duchy of Luxemburg for himself, and left his ally satisfied: but while the friendship of France was thus courted by foreign powers, the kingdom itself was in the most miserable situation. The king's distemper seemed daily to gain ground; while the discordant interests of the contending parties kept the whole nation in a ferment. The most violent animosity took place betwixt the dukes of Orleans and Burgundy. The former, by means of his own interest with the queen, and the ascendency his duchess had over the king, for some time got the better of his rival, and was made lieutenant general and governor of the kingdom; but having presumed on his power to levy new imposts on the people, and oppressing also the churchmen, whom in that superstitious age he ought by all means to have let alone, he was deprived of his authority, and obliged to yield to the duke of Burgundy. For some time, however, these powerful rivals were kept within some bounds by the mediation of the duke of Bourbon, who seems to have been the only grandee who maintained a pure and unspotted character; but by his death in 1404, the unhappy nation was left totally exposed to their relentless fury. In 1405, the queen and duke of Orleans again seized the administration; but were soon deprived of it by the unanimous voice of the people. During this period Charles and his children were neglected and abandoned to distress; but they were relieved by the duke of Burgundy on his obtaining the regency; and Isabella, with the duke of Orleans, was obliged to retire from Milan. A sudden return of the king's reason and understanding for a much longer time than usual, now deprived both parties of their power; and the administration

92 Unhappy fate of the succours sent to the Hungarians.

93 Violent commotions in France.

France. nistration was vested in the queen and a council composed of princes of the blood.

The two rival dukes, thus prohibited from interfering in public affairs, exercised themselves in committing hostilities against the English, with whom the truce had been lately concluded. They were encouraged to this infraction of the treaty by the unsettled situation of the affairs of Henry IV.; but their attempts proving unsuccessful, the truce was renewed after obtaining restoration of the princess, who had been married to Richard II. as has been already mentioned. The failure of their enterprises produced a new scene of discord betwixt the dukes, who mutually threw the blame upon each other. By the entreaties of the duke of Berry they were apparently reconciled; but the duke of Burgundy pretended friendship only in order to take

94 Duke of Orleans assassinated.

the more signal vengeance. To this he was now further inflamed by jealousy. Having hired a band of ruffians to execute his bloody purpose, the duke was one evening attacked by eighteen of them while attended only by two pages. A Norman gentleman whom the duke had deprived of an employment, headed the assassins, and in person attacked the duke. At the first blow he cut off his hand, at the second he struck him from his mule, and at the third put an end to his life. His wife Valentina was so deeply affected with his death, that she died soon after. The duke of Burgundy escaped to Flanders; and the whole nation was rent into two factions, called the *Burgundians* and *Armagnacs*; the latter being the title of the party of the duke of Orleans, from Armagnac the father-in-law of that prince. A dreadful confusion ensued: the duke of Burgundy soon returned to France, and extorted a pardon from the unhappy king, who was now no longer able to resist him: and we may have some notion of the state of the kingdom in general from being told, that 2000 people perished in one tumult in the capital. The king himself was alternately the prisoner of each party, and alternately transferred the power from the one to the other as he happened to fall into their hands. This therefore was thought by Henry V. of England, a favourable opportunity to recover from France those grants that had been formerly given up by treaty. But previously, to give his intended expedition the appearance of justice, he sent over ambassadors to Paris, offering a perpetual peace and alliance, on condition of being put in possession of all those provinces which had been ravished from the English during some former reigns, and of espousing Catharine, the French king's daughter, in marriage, with a suitable dowry. Though the French court was at that time extremely averse to war, yet the exorbitance of these demands could not be complied with; and Henry very probably made them in hopes of a denial. He

95 Invasion by Henry V. of England.

therefore assembled a great fleet and army at Southampton; and having allured all the military men of the kingdom to attend him, from the hopes of conquest, he put to sea, and landed at Harfleur, at the head of an army of 6000 men-at-arms, and 24,000 foot, mostly archers.

His first operations were upon Harfleur: which being pressed hard, promised at a certain day to surrender unless relieved before that time. The day arriving, and the garrison, unmindful of their engagement, still resolving to defend the place, Henry ordered an assault to be made, took the town by storm, and put all the garrison to the sword. From thence the victor advanced farther into the country, which had been already rendered desolate by factions, and which he now totally laid waste. But although the enemy made a feeble resistance; yet the climate seemed to fight against the English; a contagious dysentery carrying off three parts of Henry's army. In this situation he had recourse to an expedient common enough in that barbarous age, to inspire his troops with confidence in their general. He challenged the dauphin, who commanded in the French army, to single combat, offering to stake his pretensions on the event. This challenge, as might naturally be expected, was rejected; and the French, though disagreeing internally, at last seemed to unite at the appearance of the common danger. A numerous army of 14,000 men-at-arms, and 40,000 foot, was by this time assembled under the command of Count Albert, and was now placed to intercept Henry's weakened forces on their return. The English monarch, when it was too late, began to repent of his rash inroad into a country where disease and a powerful army everywhere threatened destruction; he therefore thought of retiring into Calais. In this retreat, which was at once both painful and dangerous, Henry took every precaution to inspire his troops with patience and perseverance; and showed them in his own person the brightest example of fortitude and resignation. He was continually harassed on his march by flying parties of the enemy; and whenever he attempted to pass the river Somme, across which his march lay, he saw troops on the other side ready to oppose his passage. However, he was so fortunate as to seize by surprise a passage near St Quintin, which had not been sufficiently guarded; and there he safely carried over his army.

But the enemy was still resolved to intercept his retreat: and after he had passed the small river of Tertrois at Blangi, he was surprised to observe from the heights the whole French army drawn up in the plains of Agincourt; and so posted, that it was impossible for him to proceed on his march, without coming to an engagement. A battle accordingly took place, in which the English gained a victory, the most remarkable perhaps of any recorded in history; an account of which is given under the article AGINCOURT. 96 Battle of Agincourt.

This victory, gained on the 25th of October 1415, was however attended with no immediate effects. Henry still continued to retreat, after the battle of Agincourt, out of the kingdom; and carried his prisoners to Calais, and from thence to England. In 1417, he once more landed an army of 25,000 men in Normandy; and prepared to strike a decisive blow for the crown of France, to which the English monarchs had long made pretensions. That wretched country was now in a most deplorable situation. The whole kingdom appeared as one vast theatre of crimes, murder, injustice, and devastation. The duke of Orleans was assassinated by the duke of Burgundy; and the duke of Burgundy, in his turn, fell by the treachery of the dauphin. At the same time, the duke's son, desirous of revenging his father's death, entered into a secret treaty with the English; and a league was immediately concluded at Arras, between Henry and the young duke of Burgundy, in which the king promised 97 Henry lands again in Normandy.

France.

mised to revenge the murder of the late duke; and the son seemed to insist upon no further stipulations. Henry, therefore, proceeded in his conquests without much opposition from any quarter. Several towns and provinces submitted on his approach; the city of Rouen was besieged and taken: and he soon became master of Pontoise and Gisors. He even threatened Paris by the terror of his power, and obliged the court to remove to Troyes. It was at this city that the duke of Burgundy, who had taken upon him the protection of the French king, met Henry in order to ratify that treaty which was formerly begun, and by which the crown of France was to be transferred to a stranger. The imbecility into which Charles had fallen, made him passive in this remarkable treaty; and Henry dictated the terms throughout the whole negotiation. The principal articles of this treaty were, that Henry should espouse the princess Catharine; that King Charles should enjoy the title and dignity of king for life; but that Henry should be declared heir to the crown, and should be intrusted with the present administration of the government; that France and England should for ever be united under one king, but should still retain their respective laws and privileges; that Henry should unite his arms with those of King Charles and the duke of Burgundy, to depress and subdue the dauphin and his partisans.

98 Henry marries the princess Catharine.

It was not long after this treaty, that Henry married the princess Catharine; after which he carried his father-in-law to Paris, and took a formal possession of that capital. There he obtained from the estates of the kingdom a ratification of the late compact; and then turned his arms with success against the adherents of the dauphin; who, in the mean time, wandered about a stranger in his own patrimony, and to his enemies successes only opposed fruitless expostulations.

Henry's supplies were not provided in such plenty as to enable him to carry on the war without returning in person to prevail upon his parliament for fresh succours; and, upon his arrival in England, though he found his subjects highly pleased with the splendour of his conquests, yet they seemed somewhat doubtful as to the advantage of them. A treaty, which in its consequences was likely to transfer the seat of empire from England, was not much relished by the parliament. They therefore, upon various pretences, refused him a supply equal to his exigencies or his demands; but he was resolved on pursuing his schemes; and, joining to the supplies granted at home, the contributions levied on the conquered provinces, he was able once more to assemble an army of 28,000 men, and with these he landed safely at Calais.

In the mean time, the dauphin, a prince of great prudence and activity, omitted no opportunity of repairing his ruined situation, and to take the advantage of Henry's absence from France. He prevailed upon the regent of Scotland to send him a body of 8000 men from that kingdom; and with these, and some few forces of his own, he attacked the duke of Clarence, who commanded the troops in Henry's absence, and gained a complete victory.

This was the first action which turned the tide of success against the English. But it was of short duration: for Henry soon after appearing with a considerable army, the dauphin fled at his approach; while many of the places, which held out for the dauphin in the neighbourhood of Paris, surrendered to the conqueror. In this manner, while Henry was everywhere victorious, he fixed his residence at Paris; and while Charles had a small court, he was attended with a very magnificent one. On Whitsunday 1421, the two kings and their two queens with crowns on their heads dined together in public; Charles receiving apparent homage, but Henry commanding with absolute authority.

In the mean time, the dauphin was pursued beyond the Loire, and almost totally dispossessed of all the northern provinces. He was even pursued into the south, by the united arms of the English and Burgundians, and threatened with total destruction. In this exigence, he found it necessary to spin out the war, and to evade all hazardous actions with a rival who had been long accustomed to victory. His prudence was everywhere remarkable; and, after a train of long persecutions from fortune, he found her at length willing to declare in his favour, by the death of the king of England.

99 Death of Henry and Charles.

Charles VI. died a short time after; and Charles VII. succeeded his father to a nominal throne. Nothing could be more deplorable than the situation of that monarch on assuming his title to the crown. The English were masters of almost all France; and Henry VI. though yet but an infant, was solemnly invested with regal power by legates from Paris. The duke of Bedford was at the head of a numerous army, in the heart of the kingdom, ready to oppose every insurrection; while the duke of Burgundy, who had entered into a firm confederacy with him, still remained stedfast, and seconded his claims. Yet notwithstanding these favourable appearances, Charles found means to break the leagues formed against him, and to bring back his subjects to their natural interests and their duty.

100 Desperate situation of Charles VII.

However, his first attempts were totally destitute of success. Wherever he endeavoured to face the enemy he was overthrown, and he could scarcely rely on the friends next his person. His authority was insulted even by his own servants; advantage after advantage was gained against him; and a battle fought near Verneuil, in which he was totally defeated by the duke of Bedford, seemed to render his affairs altogether desperate. But from the impossibility of the English keeping the field without new supplies, Bedford was obliged to retire into England; and in the mean time, his vigilant enemy began to recover from his late consternation. Dumois, one of his generals, at the head of 1000 men, compelled the earl of Warwick to raise the siege of Montargis; and this advantage, slight as it was, began to make the French suppose that the English were not invincible.

101 The French affairs retrieved by the Maid of Orleans.

But they soon had still greater reason to triumph in their change of fortune, and a new revolution was produced by means apparently the most unlikely to be attended with success. In the village of Domremi, near Vaucouleurs, on the borders of Lorrain, there lived a country girl, about 27 years of age, called *Joan de Arc*. This girl had been a servant at a small inn; and in that humble station had submitted to those hardy employments which fit the body for the fatigues of war. She was of an irreproachable life, and had hitherto

therto testified none of those enterprising qualities which displayed themselves soon after. She contentedly fulfilled the duties of her situation, and was remarkable only for her modesty and love of religion. But the miseries of her country seemed to have been one of the greatest objects of her compassion and regard. Her mind, inflamed by these objects, and brooding with melancholy stedfastness upon them, began to feel several impulses, which she was willing to mistake for the inspirations of heaven. Convinced of the reality of her own admonitions, she had recourse to one Baudricourt, governor of Vaucouleurs, and informed him of her destination by heaven to free her native country of its fierce invaders. Baudricourt treated her at first with neglect: but her importunities at length prevailed; and willing to make a trial of her pretensions, he gave her some attendants, who conducted her to the court, which at that time resided at Chinon.

The French court were probably sensible of the weakness of her pretensions; but they were willing to make use of every artifice to support their declining fortunes. It was therefore given out, that Joan was actually inspired; that she had been able to discover the king among the number of his courtiers, although he had laid aside all the distinctions of his authority; that she had told him some secrets, which were only known to himself; and that she had demanded, and minutely described a sword in the church of St Catharine de Fierbois, which she had never seen. In this manner, the minds of the vulgar being prepared for her appearance, she was armed cap-a-pee, and shown in that martial dress to the people. She was then brought before the doctors of the university; and they, tinctured with the credulity of the times, or willing to second the imposture, declared that she had actually received her commision from above.

When the preparations for her mission were completely blazoned, the next aim was to send her against the enemy. The English were at that time besieging the city of Orleans, the last resource of Charles, and every thing promised them a speedy surrender. Joan undertook to raise the siege; and to render herself still more remarkable, girded herself with the miraculous sword, of which she before had such extraordinary notices. Thus equipped, she ordered all the soldiers to confess themselves before they set out; she displayed in her hand a consecrated banner, and assured the troops of certain success. Such confidence on her side soon raised the spirits of the French army; and even the English, who pretended to despise her efforts, felt themselves secretly influenced with the terrors of her mission. A supply of provisions was to be conveyed into the town; Joan, at the head of some French troops, covered the embarkation, and entered Orleans at the head of the convoy which she had safely protected. While she was leading her troops along, a dead silence and astonishment reigned among the English; and they regarded with religious awe that temerity, which they thought nothing but supernatural assistance could inspire. But they were soon roused from their state of amazement by a sally from the town; Joan led on the besieged, bearing the sacred standard in her hand, encouraging them with her words and actions, bringing them to the trenches, and overpowering the besiegers in their own redoubts. In the attack of one of the forts, she was wounded in the neck with an arrow; but instantly pulling out the weapon with her own hands, and getting the wound quickly dressed, she hastened back to head the troops, and to plant her victorious banner on the ramparts of the enemy. These successes continuing, the English found that it was impossible to resist troops animated by such superior energy; and Suffolk, who conducted the attack, thinking that it might prove extremely dangerous to remain any longer in the presence of such a courageous and victorious enemy, raised the siege, and retreated with all imaginable precaution.

From being attacked, the French now in turn became the aggressors. Charles formed a body of 6000 men, and sent them to besiege Jergeau, whither the English, commanded by the earl of Suffolk, had retired, with a detachment of his army. The city was taken; Suffolk yielded himself a prisoner; and Joan marched into the place in triumph at the head of the army. A battle was soon after fought near Patay, where the English were worsted, as before; and the generals Scales and Talbot were taken prisoners.

The raising of the siege of Orleans was one part of the Maid's promise to the king of France; the crowning him at Rheims was the other. She now declared that it was time to complete that ceremony; and Charles, in pursuance of her advice, set out for Rheims at the head of 12,000 men. The towns through which he passed opened their gates to receive him; and Rheims sent him a deputation, with its keys, upon his approach. The ceremony of his coronation was there performed with the utmost solemnity; and the *Maid of Orleans* (for so she was now called) seeing the completion of her mission, desired leave to retire, alleging that she had now accomplished the end of her calling. But her services had been so great, that the king could not think of parting with her; he pressed her to stay so earnestly, that she at length complied with his request.

A tide of successes followed the performance of this solemnity; Laon, Soissons, Chateau-Thierri, Provins, and many other fortresses in that neighbourhood, submitted to him on the first summons. On the other hand, the English, discomfited and dispirited, fled in every quarter; not knowing whether to ascribe their misfortunes to the power of sorcery or to a celestial influence; but equally terrified at either. They now found themselves deprived of the conquests they had gained, in the same manner as the French had formerly submitted to their power. Their own divisions, both abroad and at home, unfitted them entirely for carrying on the war; and the duke of Bedford, notwithstanding all his prudence, saw himself divested of his strong holds in the country, without being able to stop the enemy's progress. In order, therefore, to revive the declining state of his affairs, he resolved to have Henry crowned king at Paris, knowing that the natives would be allured to obedience by the splendour of the ceremony. In 1430, Henry was accordingly crowned, all the vassals that still continued under the English power swearing fealty and homage. But it was now too late for the ceremonies of a coronation to give a turn to the affairs of the English; the generality of the kingdom had declared against them, and the remainder

102
Henry VI of England crowned king of France.

France. remainder only waited a convenient opportunity to follow the example.

An accident ensued soon after, which, though it promised to promote the English cause in France, in the end served to render it odious, and conduced to the total evacuation of that country. The duke of Burgundy, at the head of a powerful army, had laid siege to Compeign; and the Maid of Orleans had thrown herself into the place, contrary to the wishes of the governor, who did not desire the company of one whose authority would be greater than his own. The garrison, however, were rejoiced at her appearance, and believed themselves invincible under her protection. But their joy was of short duration; for Joan having the day after her arrival headed a sally, and twice driven the enemy from their entrenchments, she was at last obliged to retire, placing herself in the rear, to protect the retreat of her forces. But in the end, attempting to follow her troops into the city, she found the gates shut, and the bridge drawn up by order of the governor, who is said to have long wished for an opportunity of delivering her up to the enemy.

103 Maid of Orleans taken prisoner.

Nothing could exceed the joy of the besiegers, in having taken a person who had been so long a terror to their arms. The service of Te Deum was publicly celebrated on this occasion; and it was hoped, that the capture of this extraordinary person would restore the English to their former victories and successes. The duke of Bedford was no sooner informed of her being taken, than he purchased her of the Count Vendome, who had made her his prisoner, and ordered her to be committed to close confinement. The credulity of both nations was at that time so great, that nothing was too absurd to gain belief that coincided with their passions. As Joan but a little before, from her successes, was regarded as a saint, she was now, upon her captivity, considered as a sorceress, forsaken by the demon who had granted her a fallacious and temporary assistance. Accordingly it was resolved in council to send her to Rouen to be tried for witchcraft: and the bishop of Beauvais, a man wholly devoted to the English interest, presented a petition against her for that purpose. The university of Paris was so mean as to join in the same request. Several prelates, among whom the cardinal of Winchester was the only Englishman, were appointed as her judges. They held their court at Rouen, where Henry then resided; and the Maid, clothed in her former military apparel, but loaded with irons, was produced before the tribunal. Her behaviour there no way disgraced her former gallantry; she betrayed neither weakness nor womanish submission, but appealed to God and the pope for the truth of her former revelations. In the issue, she was found guilty of heresy and witchcraft; and sentenced to be burnt alive, the common punishment for such offences.

But previous to the infliction of this dreadful sentence upon her, they were resolved to make her abjure her former errors; and at length so far prevailed upon her, by terror and rigorous treatment, that her spirits were entirely broken by the hardships she was obliged to suffer. Her former visionary dreams began to vanish, and a gloomy distrust to take place of her late inspirations. She publicly declared herself willing to recant, and promised never more to give way to the vain delusions which had hitherto misled her, and imposed on the people. This was what her oppressors desired; and willing to show some appearance of mercy, they changed her sentence into perpetual imprisonment, and to be fed during life on bread and water. But the rage of her enemies was not yet satiated. Suspecting that the female dress which she had consented to wear, was disagreeable to her, they purposely placed in her apartment a suit of men's apparel, and watched for the effect of their temptation upon her. Their cruel artifices prevailed. Joan, struck with the sight of a dress in which she had gained so much glory, immediately threw off her penitent robes, and put on the forbidden garment. Her enemies caught her equipped in this manner; and her imprudence was considered as a relapse into her former transgressions. No recantation would suffice, and no pardon would be granted. She was condemned to be burnt alive in the market-place of Rouen; and this infamous sentence was accordingly executed with most brutal severity.

104 and cruelly put to death.

One of the first misfortunes which the English felt after this punishment, was the defection of the duke of Burgundy; who had for some time seen the error of his conduct, and wished to break an unnatural connexion, that only served to involve his country in ruin. A treaty was therefore begun and concluded between him and Charles, in which the former agreed to assist him in driving the English out of France. This was a mortal blow to their cause; and such was its effects upon the populace of London when they were informed of it, that they killed several of the duke of Burgundy's subjects, who happened to be among them at the time. It might perhaps also have hastened the duke of Bedford's death, who died at Rouen a few days after the treaty was concluded; and the earl of Cambridge was appointed his successor to the regency of France.

105 Affairs of the English totally ruined.

From this period, the English affairs became totally irretrievable. The city of Paris returned once more to a sense of its duty. Lord Willoughby, who commanded it for the English, was contented to stipulate for the safe retreat of his troops to Normandy. Thus ground was continually, though slowly, gained by the French; and notwithstanding their fields were laid waste, and their towns depopulated, yet they found protection from the weakness and divisions of the English. At length both parties began to grow weary of a war, which, though carried on but feebly, was yet a burden greater than either could support. But the terms of peace insisted upon by both were so wide of each other, that no hopes of an accommodation could quickly be expected. A truce, therefore, for twenty-two months, was concluded in 1443, which left every thing on the present footing between the parties. No sooner was this agreed upon, than Charles employed himself with great industry and judgment in repairing those numberless ills to which his kingdom, from the continuance of wars both foreign and domestic, had so long been exposed. He established discipline among his troops, and justice among his governors. He revived agriculture, and repressed faction. Thus being prepared once more for taking the field, he took the first favourable occasion of breaking the truce; and Normandy was at the same time invaded by four

powerful

France.

powerful armies; one commanded by Charles himself, a second by the duke of Brittany, a third by the count of Alençon, and a fourth by the Count Dunois. Every place opened its gates almost as soon as the French appeared before them. Rouen was the only one that promised to hold out a siege; but the inhabitants clamoured so loud for a surrender, that the duke of Somerset, who commanded the garrison, was obliged to capitulate. The battle, or rather the skirmish, of Fourmingi, was the last stand which the English made in defence of their French dominions. However, they were put to the rout, and above a thousand were slain. All Normandy and Guienne, that had so long acknowledged subjection to England, were lost in the space of a year; and the English saw themselves entirely dispossessed of a country which for above three centuries they had considered as annexed to their native dominions. Calais alone remained of all their conquests: and this was but a small compensation for the blood and treasure which had been lavished in that country, and only served to gratify ambition with a transient applause.

Thus, in the year 1450, the power of the English in France was entirely destroyed: and Charles deservedly obtained the surname of *Victorious*, on account of the vigour he had shown in driving out the invaders of his country. His satisfaction, however, was now

106 Domestic misfortunes and death of Charles.

greatly diminished by domestic misfortunes. The dauphin, forgetting the allegiance and filial duty he owed to his father, had already impeded his conquests by his seditious intrigues. He had used every endeavour to thwart the designs of his ministers, and it was supposed that he had destroyed Agnes Soreille his father's favourite mistress by poison. He had married Charlotte daughter to the duke of Savoy; which Charles had resented by a declaration of war against the duke, but had been persuaded to recal it in order to prosecute the war against Guienne, which made part of the dominions of the English. At last, weary of the disobedience of his son, he commanded him to be arrested; but Louis, informed of his design, withdrew to Franche Comte, and afterwards to Brabant; of which the duke of Burgundy (at this time sovereign of the country) was no sooner apprised, than he ordered him to be supplied with every necessary, and treated with all imaginable respect. He refused to see him, however, until he should obtain the approbation of his father; on which Louis, having in vain attempted to draw the duke into a participation of his crimes, employed himself in sowing dissension betwixt his benefactor and his son the count of Charolois, at the very time that he himself was receiving a pension of 12,000 crowns annually from the father. Thus he at last destroyed the domestic peace of his benefactor, while his unnatural behaviour created continual suspicions in the mind of his father. Charles was repeatedly informed that his own domestics, along with his undutiful son, were in a conspiracy against his life. The miserable monarch, therefore, in continual fear of being poisoned, and having none in whom he could repose any confidence, obstinately refused for some days to take any nourishment; and when at last prevailed upon by the importunities of his attendants to do so, his stomach had become incapable of receiving food, so that he died for want of sustenance in the year 1461. His body, neglected by his unnatural son, was interred at the expence of Tannegui de Chastel, who had been his faithful companion.

107 Reign of Louis XI.

On the death of Charles, his son Louis succeeded to the throne, to which he had so long aspired. He was reckoned one of the greatest politicians that ever existed; though his character was not on that account the more amiable; on the contrary, there are few princes whose history appears in a more detestable light. So destitute was he of natural affection, that he did not even attempt to conceal his joy at his father's death. He pretended much friendship for the count of Charolois, son to the duke of Burgundy, on account of the protection he had received at his father's court; and even conferred upon him a pension of 12,000 crowns annually: but all this show of affection soon degenerated into a mortal aversion on both sides. Some differences which took place between the courts of France and Castile produced an interview betwixt the two monarchs, Louis, and Henry surnamed the *Impotent*. They met at Mauleon on the confines of Navarre: but their negotiations came to nothing, and they parted with a mutual contempt of each other; Henry despising the mean and sordid appearance of Louis, as he in his turn did the gaudy magnificence of Henry. In his negotiations with the duke of Burgundy, Louis proved more successful; persuading him to restore some towns on the river Somme, which had been ceded by Charles VII. and by the possession of which the duke was in effect master of Picardy. This cession was opposed by the count of Charolois; but Louis, by corrupting John de Croy the duke's minister, obtained his end; and for the sum of 400,000 crowns the cities were delivered to him. By this transaction he effectually ensured the hatred of Charolois: and even in that very transaction the duplicity of Louis was eminently displayed; for though he had agreed to retain in those towns the officers appointed by the duke, he was no sooner in possession of them than he displaced them all, and nominated others in their stead.

108 Formidable confederacy against Louis.

The duchy of Brittany was at this time governed by Francis, a weak but generous prince, and whose defect of capacity was supplied by the abilities of his ministers. Him Louis insulted in the most grievous manner; and as Francis found himself unable to oppose such a powerful adversary alone, he joined in a close alliance with the duke of Burgundy and the count of Charolois; the latter having been grievously offended with Louis, and even accused him of attempting his life. The conspiracy was joined by several of the principal French nobility, who had been oppressed by the king; and though the secret was confided to upwards of 500 persons, not one of them ever divulged it. Louis, finding matters become very critical, marched with an army towards the capital, which the count of Charolois already insulted. A battle ensued, in which both princes exerted themselves to the utmost, though their valour was but ill seconded by the bravery of their troops. About 1500 perished on each side; but the count of Charolois remained master of the field of battle. Louis, however, after this engagement, entered the capital: where he endeavoured, by every kind concession he could think of, to conciliate the affection of his subjects; in which he succeeded so well, that though the army of insurgents was

ance.

was soon augmented to more than 100,000 men, they were unable to make themselves masters of the city. 109 Peace concluded. At last a treaty was set on foot betwixt Louis and the count of Charolois; by which the latter obtained the towns which had been formerly ceded, with the the districts of Boulogne, Guisne, Peronne, Mondidior, and Roye, as a perpetual inheritance for himself. By granting favours to the other confederates, the league 110 Treachery of Louis. was broken; and the moment that Louis found himself freed from danger, he protested against the whole treaty in the presence of some confidential members of parliament, as contrary to the interest of the crown; and therefore waited the first favourable opportunity to crush one by one those who had been ready by their united efforts to destroy himself. The duke of Bourbon, one of the most able of the confederates, was gained over, by bestowing upon him in marriage, Jane the natural daughter of Louis himself, with the dowry of Usson in Auvergne; together with Moras, Beaurepaire, and Cormillon in Dauphiny; while, by the discontents betwixt the dukes of Brittany and Normandy, he was enabled to secure the neutrality of the former, and to recover from the latter some territories which he had unwillingly ceded to him.

In 1467, Philip duke of Burgundy, from his amiable qualities surnamed *The Good*, died, and left his dominions to his son Charles count of Charolois. That fiery and impetuous prince, jealous of the growing power of France, and an implacable enemy of Louis, had entered into a secret treaty with Francis; but Louis had driven the Bretons from the posts they occupied in Normandy before the duke of Burgundy could pass the Somme. The king, however, alarmed at the power of the confederates, concluded a peace with Brittany; and, confiding in his talents for negotiation, determined to have a personal interview with the duke of Burgundy.

111 Louis imprisoned by Charles. This memorable interview took place in the year 1468; and Peronne, a city of Picardy, but belonging to the duke of Burgundy, was appointed as the place of rendezvous. To this place the politic Louis repaired with a slender train, and attended only by Cardinal Balue, the duke of Bourbon, and the count de St Pol, constable of France; seemingly without reflecting that he was entering a hostile city, where he might be confined for any length of time, or treated at the pleasure of the duke, who was his mortal enemy. Indeed he had not long been in the place when he began to see the error of his conduct; and by the daily concourse of Burgundian lords and other persons of rank, who were his avowed enemies, he became alarmed for his personal safety. His fear now suggested to him a worse measure than even the former; and he requested apartments in the castle, where it was in the power of his rival in a moment to make him a close prisoner. This event accordingly took place, and that through the arts and machinations of Louis himself. His design had been from the beginning to keep the duke of Burgundy constantly employed in domestic wars. For this purpose he had, before his interview with Charles, excited the inhabitants of Liege, who were subject to the duke of Burgundy, to revolt. It is most probable, that he did not imagine the effects of this treachery would so soon begin to appear. At the very time, however, that Louis was in the castle of Peronne, the people of Liege revolted, seized the bishop and governor; and having massacred great numbers of the adherents of Charles, retired with the prisoners they had made to the capital. Charles was soon informed of this massacre, with the additional circumstance, that the ambassadors of Louis were seen animating the insurgents to their work of destruction. He then flew into a transport of rage; commanded the gates of the castle to be shut and strictly guarded; denouncing the severest vengeance on the perfidious monarch who had so often deceived him. Louis, however, though greatly, and no doubt very justly, alarmed, did not neglect to take the proper methods for securing himself. He distributed large sums of money among those officers to whom he imagined the duke was most inclined to pay any regard, and by splendid promises and presents endeavoured to allay the resentment of his other enemies. At last the resentment of Charles having subsided, he entered into a treaty with the king, and concluded it upon much the same terms as those which had been agreed upon before. His resentment, however, still manifested itself so far, that he insisted upon Louis being present at the punishment he inflicted upon the inhabitants of Liege for the massacre they had committed, and of which we have already taken notice. This was agreed to: the two princes formed the siege of the city in conjunction; and, notwithstanding the obstinate defence of the people, it was at last taken by storm, and the inhabitants massacred. It was not long, however, before the new alliance was dissolved. A confederacy against Louis, whom neither promises nor treaties could bind, was formed betwixt his own brother the duke of Normandy and the duke of Burgundy; but before their measures were ripe for execution, Louis had already commenced hostilities. The duke of Burgundy, as a peer of France, was summoned to parliament; and on his refusal, the constable St Pol made himself master of St Quintin. Several other cities were soon after reduced; and Baldwin, the natural brother of Charles, corrupted by Louis, deserted his cause; and the haughty spirit of the duke was thus at last obliged to condescend to solicit a peace. This, however, was of no long duration. Charles, encouraged by the success of Edward IV. of England his brother-in-law, began once more to league against Louis with the dukes of Brittany and of Guienne; the latter being the king's brother, formerly duke of Normandy, but who had exchanged that duchy for the territory of Guienne. But while the affairs of the confederates seemed to be in a prosperous way, their prospects were suddenly overcast by the death of the duke of Guienne, which was universally supposed to have been occasioned by poison, and Louis was as universally looked upon as the author. The abbot of St Joan d'Angeli was fixed upon as the immediate perpetrator of the deed; but on the day appointed for his trial he was found strangled in his cell; and this also was with great probability supposed to have been the deed of Louis, who after the death of his brother instantly seized on the territory of Guienne, and annexed it to the dominions of France.

France.

112 A treaty between Louis and Charles.

By this unheard-of conduct of the French monarch, Charles was exasperated to such a degree, that he vowed the most dreadful vengeance against the unhappy people

France.

people of France, and threatened to sacrifice to the memory of the duke of Guienne every one who now fell into his hands. The citizens of Nesle were massacred without distinction of sex or age; Beauvis resisted his attacks; after which Charles wreaked his fury on other places. Having entered the country of Caux, he reduced the cities of Eu and St Valery, burnt Longueville, and wasted the whole country as far as Rouen. Louis, on the other hand, steady and constant in his designs, determined to dissolve the league between the duke of Brittany and Edward IV. of England. Accordingly he encamped with his army on the frontiers of Brittany; while the duke, not meeting with the assistance promised by Edward, was obliged to consent to a truce for a year; and the duke of Burgundy himself was obliged to follow his example, having committed such devastations as deprived him of all means of subsistence in the country, so that he could neither advance nor retreat. In a very little time, however, he again began to conspire with the king of England against Louis, and a powerful invasion was determined upon. Edward was to cross the sea with an army of 10,000 men, while Charles assembled all his forces to join him. The former was also to set up a claim to the crown of France, and at least to obtain the provinces of Normandy and Guienne; the duke was to have Champagne with some adjacent districts; to free his dominions from homage; and neither party was to make peace without the consent of the other. It was supposed that the duke of Brittany would naturally accede to the confederacy; and the Count de St Pol, constable of France, had engaged to deliver up the town of St Quintin and others which he occupied on the river Somme. Louis, however, still had the good fortune to avoid the storm. Charles, instead of advancing to the assistance of Edward, who had entered France at the head of 15,000 archers and 1500 men at arms, laid siege to the city of Nuiz on the Rhine; while the constable St Pol, instead of delivering up the towns as he had promised, deceived his allies, and enabled Louis to dissolve a confederacy, which, had it been vigorously maintained, might have involved him in the greatest difficulties. To procure the departure of Edward, however, he was obliged to consent to a tribute of 75,000 crowns, as well as to settle on the king himself 50,000 crowns for life; betrothing also the dauphin to the eldest daughter of the king of England. The duke of Burgundy exclaimed loudly against this treaty: but Edward persisted in his resolution; and it was accordingly executed at a place called *Pecquigny*, near Amiens; but in such a manner as showed the little confidence the two sovereigns reposed in each other. A grated barrier was erected in the middle of the bridge of Pecquigny, between the barriers of which only a man's arm could pass: the two princes appeared on the opposite sides of it; and having conferred privately, and confirmed the treaty between them, parted with many protestations of friendship; in which, probably, neither party was very sincere. A power was reserved by Edward, for the duke of Burgundy to accede to the treaty: but the latter haughtily replied, that he was able to support himself without the assistance of England; and that he would make no peace with Louis till three months after the return of Edward to his own country. To this resolution he adhered: but no sooner was the term expired, than he concluded a truce with Louis for nine years. The stipulations publicly agreed upon betwixt these two princes consisted only in some articles for the mutual advantage of their subjects; but privately they had signed others of a different nature. The constable St Pol having rendered himself obnoxious to all parties by his complicated treachery, fled to Mons in Hainault; but the duke of Burgundy had already consented to deliver him up on condition of receiving his estates and moveables as the price of his treachery.

113 Furious invasion of France by Charles of Burgundy.

114 Invasion by Edward IV. of England.

115 Louis agrees to pay an annual pension to Edward.

Thus was Louis, without any other remarkable qualification than the mere arts of falsehood and duplicity, got rid of all his enemies except the duke of Burgundy, whose growing power rendered him a constant object of jealousy and terror. His own imprudence and rashness, however, soon proved his ruin. Having rashly engaged in a war with the Swiss, he was defeated in the first engagement with that martial nation, with the loss of his military chest and baggage, with his plate and jewels, supposed to be the richest in Europe. His disappointment on this occasion was so great, that he was seized with a severe sickness, from which he had hardly recovered when he resumed his mad scheme of conquering the Swiss. Another battle ensued; in which, after an obstinate dispute, Charles was defeated with the loss of 18,000 men, himself escaping with great difficulty. This disaster was followed by the defection of most of his allies; the duke of Lorrain recovered the city of Nancy and great part of his dominions which Charles had seized; while the latter, overwhelmed with shame and disappointment, spent his time in solitude and inactivity. From this he was at last roused by the misfortunes which fell upon him in such quick succession. He now invested the city of Nancy; and in this, as well as in every other instance, he acted against the advice of his best officers; and the consequences were still more fatal than before. The duke of Lorrain advanced with a strong body of Germans to the relief of the city, while Charles had scarcely 4000 men to oppose him. His troops were therefore easily defeated, and himself, notwithstanding the most heroic efforts of valour, hurried away in the crowd. The count de Campobasso, an Italian nobleman in whom he put a great deal of confidence, but who was in reality a traitor, had deserted with about 80 men in the beginning of the engagement. He left 12 or 15 men about the duke's person, with strict orders to assassinate him in the tumult; and this order they punctually complied with; the body of Charles being found two days after the battle pierced with three wounds.

116 Charles engages in a war with the Swiss.

117 He is assassinated.

The news of Charles's death was received with the most unfeigned joy by Louis, whose sole object now was to unite the territories of the duke of Burgundy to his own. This might be done in two ways; one by a match betwixt the dauphin and Mary the heiress of Burgundy; the other, by marrying her to the duke of Angoulême, a prince of the royal blood of France, and on whom Mary had shewn some inclination to bestow herself. The king, however, to whom duplicity and falsehood seem to have been absolutely necessary, chose a third method, more agreeable to his character. The match with the dauphin was attended with such circumstances

118 Conquers Burgundy by Louis.

France. circumstances as rendered it evidently impracticable. The disparity of age was very great, the dauphin being only eight years old, and the princess twenty: the Flemings were besides very much averse from submitting to a prince whose powerful resources would enable him to oppress their liberties: but notwithstanding these unsurmountable difficulties, Louis chose to insist upon the match, at the same time that he endeavoured to make himself master of her dominions by force of arms. He addresssd circular letters to the principal cities of Burgundy; representing that the duchy had been given by King John to the male heirs of his son Philip; and that now, when these were extinct by the death of Charles, the territory reverted of course to the crown. To render this argument more effectual, he corrupted the governors of some towns; seduced the inhabitants of others to rise against their governors; whilst he himself at the head of an army, prepared to enforce obedience from those who could not be worked upon by other methods. Thus the province of Burgundy was entirely reduced; but Flanders could not be brought under subjection either by fair means, force, or fraud. In his conduct for this purpose, indeed, Louis displayed the most detestable as well as the meanest treachery and falsehood. To render Mary odious to her subjects, he negotiated with her ministers, and prevailed upon them to disclose to him some of the most important state secrets; after which he communicated their letters to the states of Flanders. This double treachery, however, did not at present answer his purpose. The two ministers whom he had betrayed were indeed put to death without mercy, and that even in the presence of their sovereign: but Mary herself was thus induced to bestow herself upon the emperor Maximilian; and Louis had the mortification to find that all his arts had contributed only to aggrandise a rival power, whom he had already sufficient cause to dread. To remedy this oversight, he entered into an alliance with Edward IV. of England, whom he had inspired with a jealousy of his brother Clarence, in order to prevent a match betwixt that nobleman and the princess Mary, which had also been in agitation. Thus a peace was concluded between the two monarchs, to continue during the life of each, and a year after.

The marriage of Mary with Maximilian effectually secured the independence of Flanders; while the return of the prince of Orange to the party of that princess extended the flames of war once more to the cities of Burgundy. The French were on the point of being totally expelled from that country, when Maximilian unexpectedly made proposals of peace. A truce was on this concluded between the two princes, but without any term limited for its duration, or without any conditions stipulated in favour of the Burgundians; so that the whole country was quickly after reduced by Louis.

1[illegible]
Tyranny and cruelty of Louis.

The king now freed from the apprehensions of foreign enemies, turned his vindictive disposition against his own subjects; over whom, under pretence of former rebellions, he exercised the most insupportable tyranny. The principal victim to his sanguinary disposition on this occasion was James d'Armagnac duke of Nemours, one of the first noblemen in the kingdom, but who had formerly appeared a zealous confederate against him in the league in which Edward and Charles were concerned. The unfortunate nobleman, knowing that vengeance was determined against him, fled to a fortress named *Carlat*, situated among the mountains of Auvergne. Here he was besieged by the Seigneur de Beaujeu, who had married Anne the daughter of Louis. The place, however, was almost impregnable to any force; so that his enemies were obliged to make the most solemn promises of safety in order to induce him to surrender himself. By these he was at last persuaded to trust himself in the hands of the faithless tyrant: who no sooner had him in his power than he shut him up in the Bastile in an iron cage, and reprimanded the judges because they had released him from this close confinement during the time of his examination. The judges reluctantly condemned him to be beheaded: but the king's cruelty extended beyond the sentence: and he ordered the two young sons of the duke, though yet in early childhood, to be placed directly under the scaffold, that they might be covered with the blood of their father. Four thousand persons are supposed to have perished upon this occasion without any form or trial: and were it not for the concurrent testimony of the historians of that age, the inhumanities and barbarities of this monarch are scarce to be credited. By these he broke the spirits of the French nobility, and gradually extended the power of the crown beyond all bounds; so that at last it was limited only by the sovereign's pleasure. Amidst all the perfidy and cruelty, however, for which this monarch is so justly to be detested, we may on some occasions remark a kind of magnanimity and generosity which we cannot but applaud. An instance of this was his supporting the house of Medici against Pope Sextus, whom he obliged to desist from his attacks, and to recal his sentence which he had fulminated against them.

120
Burgundy unsuccessfully invaded by Maximilian.

In 1479, the emperor Maximilian, who had lightly abandoned the duchy of Burgundy, when he might have reduced it, now renewed his claims when it was no longer in his power to enforce them. After a variety of actions of lesser note, and the destruction of cities on both sides, a decisive battle was fought at Guinegate. Here the Flemings were routed; but as the French pursued with too great ardour, the infantry of the enemy rallied, and the battle was renewed with great slaughter on both sides. A more decisive advantage was afterwards gained by the capture of 80 Flemish vessels, which induced that commercial people to think of peace. In the meantime, however, Louis, after a life spent in continual deceit, hypocrisy, and cruelty, received warning of his approaching end by a fit of apoplexy with which he was seized in the year 1480. He lay speechless and motionless for two days; after which he recovered in some degree, but never completely regained his health and strength. His illness, however, neither prevented him from pursuing the schemes of his ambition, nor from using the same methods as before to attain them. He seized, without any pretence, the estates of the duke of Bourbon, the only nobleman in the kingdom whose power could give him any cause of suspicion; yet, notwithstanding his assiduity for the interest of the dauphin, he kept him a kind of prisoner in the castle of Amboise, permitting none but his own servants, or persons

France. sons of the meanest rank, to have access to him. He banished his own consort, the mother of the dauphin, to Savoy, and endeavoured to inspire the prince with aversion towards her. By the death of Charles, the titular king of Naples, and the last of the second house of Anjou, he became master of the county of Provence; but his satisfaction on this occasion was marred by a second stroke of apoplexy. Still, however, he revived, and, with his recovery, again began to pursue his ambitious intrigues. The death of Mary of Burgundy, who perished by a fall from her horse, inspired him with new views; and he betrothed his son to the infant daughter of the emperor. Thus he offended Edward IV. of England, whose eldest daughter Elizabeth had been previously contracted to the dauphin; and a war would have undoubtedly ensued, had it not been for the death of the king of England. This was followed in no long time after by that of

121 Death of Louis XI. Louis himself, who had in vain exhausted the skill of the physician, and wearied the clerical order with prayers and processions to avert the impending stroke. He expired in the year 1483, after a reign of 23 years; during which he was detested by his subjects, whom he had continually oppressed; and equally dreaded and hated by his neighbours, whom he had constantly deceived: notwithstanding which he obtained the title of *Most Christian* from his holiness, which his successors have ever after retained.

Notwithstanding the dark character of this prince, it is undoubtedly to be allowed, that he laid the foundations of the future greatness of France. By his arts he deprived the common people of their liberty, depressed the power of the nobility, established a standing army, and even induced the states to render many taxes perpetual, which formerly were only temporary, in order to support the army which was to keep themselves in slavery. From this time the people were accustomed to submit entirely to the voice of their sovereign as their only legislator; and being always obedient in matters of the greatest consequence, they cheerfully contributed whatever sums were required to fulfil the king's pleasure.

122 Reign of Charles VIII. Charles VIII. who succeeded his father Louis XI. in 1483, was only 14 years of age at the time of his father's death: but though he might, even at that age, have ascended the throne without any material violation of the laws of France, yet it was judged necessary to have a regent, on account of the king's delicacy of constitution and want of education. Three competitors appeared as candidates for this important trust, viz. John duke of Bourbon, a prince of the blood, and who had, till the age of 60, maintained the most unblemished character; Louis duke of Orleans, presumptive heir to the crown, but who from his being only 20 years old himself, seemed incapacitated on that account from undertaking such an important office: the third competitor was Anne, the eldest daughter of Louis, to whom the latter had in

123 Regency of the Lady Beaujeu. the last moments of his life committed the charge of the kingdom, with the title of governess. The claim of this lady was supported by the assembly of the states general at Tours; and though she was only entered into the 22d year of her age, it appears that the office could not have been more properly bestowed. Being married to Peter of Bourbon, sire of Beaujeu, her present title was *the Lady of Beaujeu*; but she appears to have acted entirely independent of her husband, who was but of a modera e capacity; and indeed had been recommended to her by Louis on account of his slender abilities, lest by any other match the house of Bourbon should be too much aggrandized. Her first step was to ingratiate herself with the people, by some popul r acts; among which one was to punish the instruments of her father's cruelties. One of these, named Oliver le Dian, who, from the station of a barber, had raised himself to the confidence and favour of the king, and had distinguished himself by the invention of new modes of torture, was publicly hanged. Another, named Jean Doyac, who by continual acts of violence and rapacity had oppressed the people, was condemned, after being whipped in all the open places or squares of Paris, to have one of his ears cut off, and his tongue pierced with a hot iron; after which he was conveyed to his native city of Montferrand, where he was a ain whipped, and his other ear cut off; after which his estates, as well as those of Oliver, were confiscat . Jacques Coitier, the physician of Louis, who had availed himself of the terror of death with which the king was strongly influenced, to extort great sums of money from him, was ordered to answer for the immense wealth he had acquired; but he averted the danger by paying a fine of 50,000 crowns.

Thus the lady de Beaujeu gained the affection of the people at large; and was equally successful in gaining over those who were averse to her government. The duke of Bourbon was made constable, an office which he had long desired; but the duke of Orleans behaved in such a manner as to exclude all hopes of favour. Incensed at the determination of a trifling dispute at tennis against him, by the lady Beaujeu, he exclaimed, that whoever had decided in that manner "was a liar if a man, or a strumpet if a woman." After this furious declaration he fled to the castle of Beaujency, where, however, he was soon forced to surrender. He then applied to Henry VII. of England, who had newly ascended the throne of England; but that prince, naturally slow and cautious, did not pay much attention to his proposals; on which he next made his application to the court of Britanny. Here he was received 124 Duke of Orleans flies to Britany.
with great marks of esteem, and began to entertain hopes of marrying the daughter of the duke; but being looked upon with a jealous eye by the nobility, they entered into secret negotiations with Anne, and even solicited her to invade the conntry. In these negotiations, however, they stipulated that only a certain number of troops should enter the province, and that no fortified place should remain in the hands of the French; which conditions were indeed agreed to by the regent, though she determined to keep them no longer than it answered her purpose. In pursuance of 125 That country invaded by the French.
this resolution, Brittany was invaded at once by four armies, each of them superior to the stipulated number, who quickly made themselves masters of the most important places in the country; while the troops of the duke retired in disgust, leaving them to pursue their conquests as they pleased. Finding at last, however, that the entire subjection of their country was determined upon, the nobility began to exert themselves in defence of it; and, inflamed by the enthusiasm of liberty

France.

ty, they raised an army of 60,000 men. By these the French were compelled to abandon the siege of Nantz; but this proved only a transient gleam of success. Anne persevered in her design of completing the conquest of the country, and the state of Europe at that time favoured the design. Of all the European states, England alone was then capable of affording any effectual assistance: and the slow caution of Henry prevented him from giving the assistance which for his own interest he ought to have done. Thus the Bretons were left to defend themselves the best way they could; and having ventured a battle, they were entirely defeated, and most of their leaders taken prisoners. A small body of English, under the command of Lord Woodville, who assisted them, were entirely cut in pieces. The duke soon after died by a fall from his horse, leaving his dominions to his daughter Anne, at that time only 13 years of age. A marriage was negotiated betwixt this princess and Maximilian king of the Romans, who had been married to Mary of Burgundy; but by reason of the poverty of that prince it was never completed. The lady Beaujeu, then finding that the absolute conquest of Brittany would still be a difficult matter, determined to conclude a marriage betwixt the young king of France and the duchess, though the former had already been married to Margaret of Austria, the daughter of Maximilian. This marriage indeed had not been consummated by reason of the tender age of the princess; but she had been sent to Paris for her education, and had for several years been treated as queen of France. In 1491, however, Margaret was sent back to her father: Anne of Brittany for a long time refused to violate the engagements into which she had entered; but at last, finding herself distressed on all sides, and incapable of resisting the numerous forces of France with which she was pressed, she reluctantly consented to the match, and the nuptials were celebrated the same year at Langeais in Touraine.

126
Marriage between the king of France and duchess of Brittany.

Maximilian, whose poverty had prevented him from giving any assistance to his bride, or even from coming to see her, enraged at the double disgrace he had suffered, began, when too late, to think of revenge. France was now threatened with an invasion from the united forces of Austria, Spain, and England. But this formidable confederacy was soon dissipated.—Henry, whose natural avarice had prevented him from giving the necessary assistance, was bought off with money: the immediate payment of 745,000 crowns, and the promise of 25,000 annually ever after, persuaded him to retire into his own country. Ferdinand king of Spain had the counties of Roussillon and Cerdagne restored to him; while Maximilian was gratified by the cession of part of Artois, which had been acquired by Louis XI.

127
His expedition into Italy, and surprising success.

The young king of France agreed to these terms the more readily, that he was impatient to undertake an expedition into Italy, in order to conquer the kingdom of Naples, to which he claimed a right. Most of his counsellors were against the expedition; but the king was inflexible, even though Ferdinand king of Naples offered to do homage for his kingdom, and pay him a tribute of 50,000 crowns a-year. He appointed Peter duke of Bourbon regent in his absence; after which he set out on his expedition with very few troops and very little money. By the way he fell ill of the smallpox, but in a short time recovered, and entering Italy with only 6000 horse and 12,000 foot, he was attended with the most surprising success, traversing the whole country in six weeks, and becoming master of the kingdom of Naples in less than a fortnight. Such extraordinary good fortune seemed miraculous; and he was reckoned an instrument raised up by God to destroy the execrable tyrants with which Italy was at that time infested. Had Charles made use of this prepossession in his favour, and acted up to the character generally given him, he might have raised his name as high as any hero of antiquity. His behaviour, however, was of a very different nature. He amused himself with feasts and shows; and leaving his power in the hands of favourites, they abandoned it to whoever would purchase titles, places, or authority, at the rates they imposed; and the whole force he proposed to leave in his new conquered dominions amounted to no more than 4000 men.

But while Charles was thus losing his time, a league was concluded against him at Venice; into which entered the pope, the emperor Maximilian, the archduke Philip, Ludovic Sforza, and the Venetians. The confederates assembled an army of 40,000 men, commanded by Francis marquis of Mantua; and they waited for the king in the valley of Fornova, in the duchy of Parma, into which he descended with 9000 men. On the 6th of July 1495 he attacked the allies; and, notwithstanding their great superiority, defeated them, with the loss of only 80 of his own men. Thus he got safe to France; but his Italian dominions were lost almost as soon as he departed. Some schemes were proposed for recovering these conquests; but they were never put in execution, and the king died of an apoplexy in 1498.

128
His death.

The premature death of this monarch in the 28th year of his age, was supposed to have been owing to his irregular life, and particularly his attachment to women; which had for some time impaired his health, and brought on evident symptoms of his approaching dissolution. At last he relinquished his irregularities, and retired with the queen to the castle of Ambloise. Here in passing through a low door he struck his head with violence against the top. No unfavourable symptom appeared at the time; but soon afterwards, as he conversed with his confessor, and avowed his design of observing the nuptial fidelity he owed to the queen, he suddenly fell backward in a fit of apoplexy. He recovered his voice three times, and uttered some expressions of devotion; but instantly relapsed, and in a short time expired, notwithstanding every assistance that could be given. He was greatly celebrated for his sweet temper and agreeable disposition, which procured him the surnames of the *Affable* and *Courteous*. Two of his domestics are said to have died of grief after his death, and his widow abandoned herself to the most pungent sorrow for *two days*.

By the death of Charles VIII. the throne of France passed from the direct line of the house of Valois, and Louis duke of Orleans succeeded to the throne. At the time of his accession he was in his 36th year, and had long been taught prudence in the school of adversity. During the administration of the lady Beaujeu, he had been, as we have already observed, constantly in disgrace; and after his connexions with the duke

duke of Brittany, had spent a very considerable time in prison; and though afterwards set at liberty by Charles, he had never possessed any share of that monarch's confidence or favour. Towards the conclusion of that reign, he fell under the displeasure of the queen; and had afterwards continued at his castle of Blois till he was called from thence to the possession of the kingdom. He had been married in early life, and against his will, to Jane the youngest daughter of Louis XI. a princess of an amiable disposition, but deformed in her person, and supposed to be incapable of bearing children. Afterwards he entertained thoughts of having his marriage dissolved, and was supposed to possess the affection of the duchess of Brittany, before she became queen of France. After the death of her husband, that princess retired to Brittany, where she pretended to assume an independent sovereignty; but Louis having got his marriage with Jane dissolved by Pope Alexander VI. quickly after made proposals to the queen-dowager, which on her part were accepted without hesitation; though it was stipulated, that if she should have two sons, the younger should inherit the duchy of Brittany.

As Louis, while duke of Orleans, had some pretensions to the kingdom of Naples, he instantly set about realizing them by conquest. On his accession, he found matters in that country much more favourable to his designs than formerly. The pope, Alexander VI. was very much in his interests, from the hopes of getting his son Cæsar Borgia provided for: he had conciliated the friendship of the Venetians by promising them a part of the Milanese; he concluded a truce with the archduke Philip; and renewed his alliances with the crowns of England, Scotland, and Denmark.

120 Expedition of Louis XII. into Italy.

He then entered Italy with an army of 20,000 men; and being assisted by the Venetians, quickly conquered one part of the duchy, while they conquered the other, the duke himself being obliged to fly with his family to Inspruck. He then attacked Ferdinand of Spain with three armies at once, two to act by land, and one by sea; but none of these performing any thing remarkable, he was obliged to evacuate the kingdom of Naples in 1504.

In 1506, the people of Genoa revolted; drove out the nobility; chose eight tribunes; and declared Paul Nuova, a silk dyer, their duke: after which they expelled the French governor, and reduced a great part of the Riviera. This occasioned Louis's return into Italy; where, in 1507, he obliged the Genoese to surrender at discretion: and, in 1508, entered into the league of Cambray, with the other princes who at that time wanted to reduce the overgrown power of the Venetians. Pope Julius II. who had been the first contriver of this league, very soon repented of it; and declared, that if the Venetians would restore the cities of Faenza and Rimini, which had been unjustly taken from him, he would be contented. This was refused; and in 1509, the forces of the republic received such an entire defeat from Louis, that they agreed to restore not only the two cities demanded by Pope Julius, but whatever else the allies required.

The pope now, instead of executing his treaties with his allies, made war on the king of France without the least provocation. Louis called an assembly of his clergy; where it was determined, that in some cases it was lawful to make war upon the pope; upon which the king declared war against him, and committed the care of his army to the Marshal de Trivulce. He soon obliged the pope to retire into Ravenna; and in 1511, Gaston de Foix, duke of Nemours, gained a great victory at Ravenna, but was himself killed in the engagement. After his death the army was disbanded for want of pay; and the French affairs in Italy, and everywhere else, fell into great confusion. They recovered the duchy of Milan, and lost it again in a few weeks. Henry VIII. of England invaded France, and took Terruenne and Tournay; and the Swiss invaded Burgundy with an army of 25,000 men. In this desperate situation of affairs the queen died, and Louis put an end to the opposition of his most dangerous enemies by negotiating marriages. To Ferdinand of Spain he offered his second daughter for either of his grandsons, Charles or Ferdinand; and to renounce, in favour of that marriage, his claims on Milan and Genoa. This proposal was accepted; and Louis himself married the princess Mary, sister to Henry VIII. of England. This marriage he did not long survive, but died on the 2d of January 1514; and was succeeded by Francis I. count of Angoulesme, and duke of Bretagne and Valois.

130 His marriage with the princess Mary of England, and death.

131 Francis I. invades Italy.

The new king was no sooner seated on the throne, than he resolved on an expedition into Italy. In this he was at first successful, defeating the Swiss at Marignon, and reducing the duchy of Milan. In 1518, the emperor Maximilian dying, Francis was very ambitious of being his successor, and thereby restoring to France such a splendid title, which had been so long lost. But Maximilian, before his death, had exerted himself so much in favour of Charles V. of Spain, that Francis found it impossible to succeed; and from that time an irreconcileable hatred took place between the two monarchs. In 1521, this ill will produced a war; which, however, might perhaps have been terminated, if Francis could have been prevailed upon to restore the town of Fontarabia, which had been taken by his admiral Bonivet: but this being refused, hostilities were renewed with greater vigour than ever; nor were they concluded till France was brought to the very brink of destruction. The war was continued with various success till the year 1524; when Francis having invaded Italy, and laid siege to Pavia, he was utterly defeated before that city, and taken prisoner on the 24th of February.

132 Defeated and taken prisoner.

This disaster threw the whole kingdom into the utmost confusion. The Flemish troops made continual inroads; many thousand boors assembled in Alsace, in order to make an invasion from that quarter; Henry VIII. had assembled a great army, and threatened the kingdom on that side also; and a party was formed in the kingdom, in order to dispossess the duchess of the regency, and confer it upon the duke de Vendosme. This prince, however, who, after the constable, was the head of the house of Bourbon, went on purpose to Lyons, where he assured the regent that he had no view but for her service, and that of his country; upon which he formed a council of the ablest men of the kingdom, and of this she made him president. The famous Andrew Doria sailed with the French galleys to take on board the remains of the French troops under the duke of Alva, whom he landed safely in France. Those who escaped out of the Milanese

France.

Milanese also made their way back again as well as they could. Henry VIII. under the influence of Cardinal Wolsey, resolved not to oppress the oppressed: he therefore assured the regent that she had nothing to fear from him; and at the same time advised her not to consent to any treaty by which France was to be dismembered. To the emperor, however, he used another language. He told him, that the time was now come when this puissant monarchy lay at their mercy; and therefore, that so favourable an opportunity should not be let slip: that, for his part, he should be content with Normandy, Guienne, and Gascony, and hoped the empire would make no scruple of owning him king of France: adding, that he expected the emperor would make a right use of his victory, by entering Guienne in person; in which case he was ready to bear half the expence of the war. He foresaw what fell out; the emperor was alarmed at these conditions, and did not care to have him for a neighbour; for which reason he agreed to a truce with the regent for six months. In Picardy the Flemings were repulsed; and the count de Guise, with the duke of Lorrain, had the good fortune, with a handful of troops, to defeat and cut to pieces the German peasants.

[1]33 Francis I. carried to Madrid, where he signs a disadvantageous treaty;

In the mean time, Francis was detained in captivity in Italy: but being wearied of his confinement in that country, and the princes of Italy beginning to cabal for his deliverance, he was carried to Madrid; where, on the 14th of January 1525, he signed a treaty, the principal articles of which were, That he should resign to the emperor the duchy of Burgundy in full sovereignty; that he should desist from the homage which the emperor owed him for Artois and Flanders; that he should renounce all claim to Naples, Milan, Asti, Tournay, Lisle, and Hesden, &c.; that he should persuade Henry d'Albert to resign the kingdom of Navarre to the emperor, or at least should give him no assistance; that within 40 days he should restore the duke of Bourbon and all his party to their estates; that he should pay the king of England 500,000 crowns which the emperor owed him; that when the emperor went to Italy to receive the Imperial crown, he should lend him 12 galleys, four large ships, and a land army, or instead of it 200,000 crowns.

All these articles the king of France promised on the word and honour of a prince to execute; or, in case of non-performance, to return prisoner into Spain. But, notwithstanding these professions, Francis had already protested before certain notaries and witnesses in whom he could trust, that the treaty he was about to sign was against his will, and therefore null and void. On the 21st of February, the emperor thought fit to release him from his prison, in which he had been closely confined ever since his arrival in Spain; and after receiving the strongest assurances from his own mouth, that he would literally fulfil the terms of the treaty, sent him under a strong guard to the frontiers, where he was exchanged for his two eldest sons, who were to remain as hostages for his fidelity.

and breaks it.

When the king returned to his dominions, his first care was to get himself absolved by the pope from the oaths he had taken; after which he entered into a league with the pontiff, the Venetians, the duke of Milan, and the king of England, for preserving the peace of Italy. In the month of June, he publicly received remonstrances from the states of Burgundy; in which they told him, without ceremony, that by the treaty of Madrid he had done what he had no right to do, in breach of the laws and his coronation oath; adding, that if he persisted in his resolution of throwing them under a foreign yoke, they must appeal to the general states of the kingdom. At these remonstrances the viceroy of Naples and the Spanish ministers were present. They perceived the end which the king aimed at, and therefore expostulated with him in pretty warm terms. At last the viceroy told him, that he had now nothing left but to keep his royal word in returning to the castle of Madrid, as his predecessor John had done in a like case. To this the king replied, that King John acted rightly; that he returned to a king who had treated him like a king; but that at Madrid he had received such usage as would have been unbecoming to a gentleman: that he had often declared to the emperor's ministers, that the terms they extorted from him were unjust and impracticable: but that he was still willing to do all that was fit and reasonable; and to ransom his sons at the rate of two millions of gold, in lieu of the duchy of Burgundy.

Hitherto the treaty for the tranquillity of Italy had been kept secret, in hopes that some mitigation of the treaty of Madrid would have been obtained; but now it was judged expedient to publish it, though the viceroy of Naples and the Spanish lords were still at the French court; and the emperor was to be admitted into it, provided he accepted the king's offer of two millions for the release of his children, and left the duke of Milan and other Italian princes in quiet possession of their dominions. It is the common misfortune of all leagues, that the powers who enter into them keep only their own particular interests in view, and thus defeat the general intention of the confederacy. This was the case here. The king's great point was to obtain his children upon the terms he had proposed; and he was desirous of knowing what hopes there were of that, before he acted against the monarch who had them in his power. Thus the duke of Milan and the pope were both sacrificed. The former was obliged to surrender to the duke of Bourbon, and the latter was surprised by the Colonnas; both of which disasters would have been prevented if the French succours had entered Italy in time. See ITALY.

According to an agreement which had been made between Francis and Henry, their ambassadors went into Spain, attended each of them by a herald, in order to summon the emperor to accept the terms which had been offered him; or, in case of refusal, to declare war. It seems the emperor's answer was foreseen in the court of France; and therefore the king had previously called together an assembly of the notables; that is, persons of the several ranks of his people in whom he could confide. To them he proposed the great question, Whether he was bound to perform the treaty of Madrid? or, Whether if he did not perform it, he was obliged in honour to return to Spain? To both these questions, the assembly answered in the negative: they said, that Burgundy was united to the crown of France, and that he could not separate it by his own authority; that his person also was the property of the public, of which therefore he could not dispose; but for the two millions, which they looked upon

France. upon as a just equivalent, they undertook that it should be raised for his service. When the ambassadors delivered their propositions, Charles treated the English herald with respect, and the French one with contempt; which produced a challenge from Francis to the emperor †. All differences, however, were at last

135 Treaty of Cambray. adjusted; and a treaty was concluded at Cambray, on the 5th of August 1528. By this treaty, instead of the possession, the emperor contented himself with reserving his right to the duchy of Burgundy, and the two millions of crowns already mentioned. Of these he was to receive 1,200,000 in ready money: the prince's lands in Flanders belonging to the house of Bourbon were to be delivered up; these were valued at 400,000 more: and the remaining 400,000 were to be paid by France in discharge of the emperor's debt to England. Francis was likewise to discharge the penalty of 500,000 crowns which the emperor had incurred, by not marrying his niece the princess Mary of England; and to release a rich *fleur-de-lis* which had been many years before pawned by the house of Burgundy for 50,000 crowns. The town and castle of Hesden were also yielded; together with the sovereignty of Flanders and Artois, and all the king's pretensions in Italy. As for the allies of France, they were abandoned to the emperor's mercy, without the least stipulation in their favour; and Francis himself protested against the validity of the treaty before he ratified it, as did also his attorney-general before he registered it in parliament; but both of them with the greatest secrecy imaginable.

† See *Duel*.

Nothing farther of much consequence happened during the remainder of the reign of Francis I. The war was soon renewed with Charles, who made an invasion

136 Francis dies and is succeeded by Henry II. into France, but with very bad success; nor was peace fully established but by the death of Francis, which happened on the 3d of March, 1547. He was succeeded by his son Henry II. who ascended the throne that very day on which he was 29 years of age. In the beginning of his reign, an insurrection happened in Guienne, owing to the oppressive conduct of the officers who levied the salt tax. The king despatched against the insurgents two bodies of troops; one commanded by the duke of Aumale son to the duke of Guise, the other by the constable. The first behaved with the greatest moderation, and brought back the people to their duty without making many examples: the other behaved with the utmost haughtiness and cruelty; and though the king afterwards remitted many of his punishments, yet from that time the constable became odious to the people, while the family of Guise were highly respected.

137 Henry persecutes the Protestants. In 1548, the king began to execute the edicts which had been made against the Protestants with the utmost severity; and, thinking even the clergy too mild in the prosecution of heresy, erected for that purpose a chamber composed of members of the parliament of Paris. At the queen's coronation, which happened this year, he caused a number of Protestants to be burned, and was himself present at the spectacle. He was, however, so much shocked, that he could never forget it; but complained, as long as he lived, that, at certain times, it appeared before his eyes, and troubled his understanding.

In 1549, a peace being concluded with England, the king purchased Boulogne from the latter, for the sum of 400,000 crowns; one half to be paid on the day of restitution, and the other a few months after. Scotland was included in the treaty, and the English restored some places they had taken there. This was the most advantageous peace that France had hitherto made with England; the vast arrears which were due to that crown being in effect remitted; and the pension, which looked so like tribute, not being mentioned, was in fact extinguished. The earl of Warwick himself, who had concluded the peace, was so sensible of the disgrace suffered by his nation, on this occasion, that he pretended to be sick, in order to avoid setting his hand to such a scandalous bargain. 138 Advantageous treaty with England.

This year, an edict was made to restrain the extravagant remittances which the clergy had been in use of making to the court of Rome, and for correcting some other abuses committed by the papal notaries. With this edict Pope Julius III. was highly displeased; and the following year (1550) war was declared by the king of France against the pope and the emperor. The pretence was, that Henry protected Octavio Farnese duke of Parma, whom the pope was desirous of depriving of his dominions. In this war the king was threatened with the censures of the church, more especially when it was known that he had entered into an alliance with the Turks, and a Turkish fleet entered the Mediterranean, where they threatened the isle of Gozo, and made descents upon Sicily. Henry, however, strongly denied any such connexion, and insisted that the emperor had given them sufficient provocation: but be that as it will, the emperor soon found himself in such danger from these new enemies, that he could not support the pope as he intended, who on that account was obliged to sue for peace. After this the king continued the war against the emperor with success; reducing the cities of Toul, Verdun, and Metz. He then entered the country of Alsace, and reduced all the fortresses between Hagenau and Wissenburg. He failed, however, in his attempt on Strasburg; and was soon after obliged by the German princes and the Swiss to desist from farther conquests on that side. This war continued with very little interruption, and as little success on the part of the French, till the year 1557, when a peace was concluded; and soon after, the king was killed at a tournament by one Count de Montgomery, who was reckoned one of the strongest knights in France, and who had done all he could to avoid this encounter with the king. 139 Henry's success against the emperor. 140 He is killed at a tournament.

The reign of his successor Francis II. was remarkable only for the persecution of the Protestants; which became so grievous, that they were obliged to take up arms in their own defence. This occasioned several civil wars, the first of which commenced in the reign of Charles IX. who succeeded to the throne in 1560. This first war continued till the year 1562, when a peace was concluded, by which the Protestants were to have a free pardon and liberty of conscience. In 1565, the war broke out anew, and was continued with very little interruption till 1569, when peace was again concluded upon very advantageous terms for the Protestants. After this King Charles, who had now taken the government into his hands, caressed the Protestants in an extraordinary manner. He invited to court 141 Civil wars with the Protestants.

court the admiral Coligni, who was the head of the Protestant party; and cajoled him so, that he was lulled into a perfect security, notwithstanding the many warnings given him by his friends, that the king's fair speeches were by no means to be trusted; but he had soon reason to repent his confidence. On the 22d of August 1571, as he was walking from the court to his lodgings, he received a shot from a window, which carried away the second finger of his right hand, and wounded him grievously in the left arm. This he himself ascribed to the malice of the duke of Guise, the head of the Catholic party. After dinner, however, the king went to pay him a visit, and amongst others made him this compliment: "You have received the wound, but it is I who suffer:" desiring at the same time that he would order his friends to quarter about his house, and promising to hinder the Catholics from entering that quarter after it was dark. This satisfied the admiral of the king's sincerity; and hindered him from complying with the desires of his friends, who would have carried him away, and who were strong enough to have forced a passage out of Paris if they had attempted it.

142 Dreadful massacre of the Protestants.

In the evening, the queen mother, Catharine de Medicis, held a cabinet council to fix the execution of the massacre of the Protestants, which had been long meditated. The persons of which this council was composed, were, Henry duke of Anjou, the king's brother; Gonzagua duke of Nevers; Henry of Angoulesme grand prior of France, and bastard brother of the king; and marshal de Tavannes; and Albert de Gondi, count de Retz: the direction of the whole was given to the duke of Guise, to whom the administration had been entirely confided during the former reign. The guards were appointed to be in arms, and the city officers were to dispose the militia to execute the king's orders, of which the signal was the ringing of a bell near the Louvre. Some say, that when the hour approached, which was that of midnight, the king grew undetermined: that he expressed his horror at shedding so much blood, especially considering that the people whom he was going to destroy were his subjects, who had come to the capital at his command, and in confidence of his word; and particularly the admiral, whom he had detained so lately by his caresses. The queen mother, however, reproached him with his cowardice, and represented to him the great danger he was in from the Protestants; which at last induced him to consent. According to others, however, the king himself urged on the massacre; and when it was proposed to him to take off only a few of the heads, he cried out, "If any are to die, let there not be one left to reproach me with breach of faith."

As soon as the signal was given, a body of Swiss troops of the Catholic religion, headed by the duke of Guise, the chevalier d'Angoulesme, accompanied by many persons of quality, attacked the admiral's house. Having forced open the doors. the foremost of the assasins rushed into the apartment; and one of them asked if he was Coligni? To this he answered that he was; adding, "Young man, respect these gray hairs:" to which the assasin replied by running him through the body with a sword. The duke of Guise and the chevalier growing impatient below stairs, cried out to know if the business was done; and being told that it was, commanded that the body should be thrown out at the window. As soon as it fell on the ground, the chevalier, or (as some say) the duke of Guise, wiping the blood off the face, kicked it with his foot. The body was then abandoned to the fury of the populous; who, after a series of indignities, dragged it to the common gallows, to which they chained it by the foot, the head being cut off and carried to the queen mother; who, it is said, caused it to be embalmed and sent to Rome. The king himself went to see the body hang upon the gibbet; where a fire being kindled under it, part was burnt, and the rest scorched. In the Louvre, the gentlemen belonging to the king of Navarre and the prince of Condé were murdered under the king's eye. Two of them, wounded and pursued by the assasins, fled into the bedchamber of the queen of Navarre and jumped upon her bed, beseeching her to save their lives; and as she went to ask this favour of the queen mother, two more, under the like circumstances rushed into the room, and threw themselves at her feet. The queen mother came to the window to enjoy these dreadful scenes; and the king, seeing the Protestants who lodged on the other side of the river, flying for their lives, called for his long gun, and fired upon them. In the space of three or four days, many thousands were destroyed in the city of Paris, by the most cruel deaths which malice itself could invent. Peter Ramus, professor of philosophy and mathematics, after being robbed of all he had, his belly being first ripped open, was thrown out of a window. This so much affected Denis Lambin, the king's professor, that, though a zealous Catholic, he died of terror. The first two days, the king denied it was done by his orders, and threw the whole blame on the house of Guise: but, on the 28th of August, he went to the parliament, avowed it, was complimented upon it, and directed a process against the admiral, by which he was stigmatized as a traitor. Two innocent gentlemen suffered as his accomplices in a pretended plot against the life of the king, in order to set the crown on the head of the prince of Condé. They were executed by torch light; and the king and the queen mother (with the king of Navarre and the prince of Condé by force) were spectators of this horrid deed; and they also assisted at the jubilee to thank God for the execution of such an infamous design.

The massacre was not confined to the city of Paris alone. On the eve of St Bartholomew, orders had been sent to the governors of provinces to fall upon the Protestants themselves, and to let loose the people upon them; and though an edict was published before the end of the week, assuring them of the king's protection, and that he by no means designed to exterminate them because of their religion, yet private orders were sent, of a nature directly contrary; in consequence of which, the massacre, or (as, in allusion to the Sicilian vespers†, it is now styled) the *Matins of Paris*, were repeated in Meaux, Orleans, Troyes, Angers, Thoulouse, Rouen, and Lyons; so that in the space of two months 30,000 Protestants were butchered. The next year Rochelle, the only strong fortress which the Protestants held in France, was besieged, but was not taken without the loss of 24,000 of the Catholics who besieged it. After this a pacification ensued on terms favourable

† See Sicily.

France. favourable to the Protestants, but to which they never trusted.

This year the duke of Anjou was elected king of Poland, and soon after set out to take possession of his new kingdom. The king accompanied him to the frontiers of the kingdom; but during the journey was seized with a slow fever, which from the beginning had a very dangerous appearance. He lingered for some time under the most terrible agonies both of body and mind; and at last died on the 30th of May 1572, having lived 24 years, and reigned 13. It is said, that after the dreadful massacre above mentioned, this prince had a fierceness in his looks, and a colour in his cheeks, which he never had before. He slept little, and never sound. He waked frequently in agonies, and had soft music to compose him again to rest.

143 Death of Charles IX.

144 Henry III.

During the first years of the reign of Henry III. who succeeded his brother Charles, the war with the Protestants was carried on with indifferent success on the part of the Catholics. In 1575, a peace was concluded, called by way of eminence the *Edict of Pacification*. It consisted of no fewer than 63 articles; the substance of which was, that liberty of conscience, and the public exercise of religion, were granted to the reformed, without any other restriction than that they should not preach within two leagues of Paris or any other part where the court was; party chambers erected in every parliament, to consist of equal numbers of Catholics and Protestants, before whom all judgments were to be tried; the judgments against the admiral, and, in general, all who had fallen in the war or been executed, were reversed; and eight cautionary towns were given to the Protestants.

145 Catholic league formed.

The edict gave occasion to the Guises to form an association, in defence, as was pretended, of the Catholic religion, afterwards known by the name of the *Catholic League*. In this league, though the king was mentioned with respect, he could not help seeing that it struck at the very root of his authority: for, as the Protestants had already their chiefs, so the Catholics were, for the future, to depend entirely upon the chief of the league; and were, by the very words of it, to execute whatever he commanded, for the good of the cause, against any, without exception of persons. The king, to avoid the bad effects of this, by the advice of his council declared himself head of the league; and of consequence recommenced the war against the Protestants, which was not extinguished as long as he lived.

The faction of the duke of Guise, in the mean time, took a resolution of supporting Charles cardinal of Bourbon, a weak old man, as presumptive heir of the crown. In 1584 they entered into a league with Spain, and took up arms against the king; and though peace was concluded the same year, yet in 1587 they again proceeded to such extremities, that the king was forced to fly from Paris. Another reconciliation was soon after effected; but it is generally believed that the king from this time resolved on the destruction of Guise. Accordingly, finding that this nobleman still behaved towards him with his usual insolence, the king caused him to be stabbed, as he was coming into his presence, by his guards, on the 23d of December 1587. The king himself did not long survive him; being stabbed by one James Clement, a Jacobine monk, on the first of August 1588. His wound at first was not thought mortal; but his frequent swooning quickly discovered his danger; and he died next morning, in the 39th year of his age, and 16th of his reign.

146 Duke of Guise murdered, and likewise the king.

Before the king's death, he nominated Henry Bourbon king of Navarre for his successor on the throne of France; but as he was a Protestant, or at least one who greatly favoured their cause, he was at first owned by very few except those of the Protestant party. He met with the most violent opposition from the members of the Catholic league; and was often reduced to such straits, that he went to people's houses under colour of visits, when in reality he had not a dinner in his own. By his activity and perseverance, however, he was at last acknowledged throughout the whole kingdom, to which his abjuration of the Protestant religion contributed not a little. As the king of Spain had laid claim to the crown of France, Henry no sooner found himself in a fair way of being firmly seated on the throne, than he formally declared war against that kingdom; in which he at last proved successful, and in 1597 entered upon the quiet possession of his kingdom.

147 Henry IV.

The king's first care was to put an end to the religious disputes which had so long distracted the kingdom. For this purpose he granted the famous edict, dated at Nantz, April 13. 1598. It re-established, in a most solid and effectual manner, all the favours that had ever been granted to the reformed by other princes; adding some which had not been thought of before, particularly the allowing them a free admission to all employments of trust, profit, and honour; the establishing chambers in which the members of the two religions were equal; and the permitting their children to be educated without constraint in any of the universities. Soon after, he concluded peace with Spain upon very advantageous terms. This gave him an opportunity of restoring order and justice throughout his dominions; of repairing all the ravages occasioned by the civil war; and abolishing all those innovations which had been made, either to the prejudice of the prerogatives of the crown or the welfare of the people. His schemes of reformation, indeed, he intended to have carried beyond the boundaries of France. If we may believe the duke of Sully, he had in view no less a design than the new-modelling of all Europe. He imagined that the European powers might be formed into a kind of Christian republic, by rendering them as nearly as possible of equal strength; and that this republic might be maintained in perpetual peace, by bringing all their differences to be decided before a senate of wise, disinterested, and able judges: and then he thought it would be no difficult matter to overturn the Ottoman empire. The number of these powers was to be 15; viz. the Papacy; the empire of Germany; France; Spain; Hungary; Great Britain; Bohemia; Lombardy; Poland; Sweden; Denmark; the republic of Venice; the States General; the Swiss Cantons; and the Italian commonwealth, which was to comprehend the states of Florence, Genoa, Lucca, Modena, Parma, Mantua, and Monaco. In order to render the states equal, the empire was to be given to the duke of Bavaria; the kingdom of Naples to the pope; that of Sicily

148 Edict of Nantz

149 The king proposes new-modelling the European powers.

Sicily to the Venetians; Milan to the duke of Savoy, who, by his acquisition, was to become king of Lombardy; the Austrian Low Countries were to be added to the Dutch republic; Franche Compte, Alsace, and the country of Trent, were to be given to the Swiss. With a view, is is now thought, of executing this grand project, but under pretence of reducing the exorbitant power of the house of Austria, Henry made immense preparations both by sea and land; but if he really had such a design, he was prevented by death from attempt-
150 He is murdered. ing to execute it. He was stabbed in his coach by one Ravilliac, on the 12th of May 1608.

On the death of Henry IV. the queen mother assumed the regency. Ravilliac was executed, after suffering horrid tortures. It is said that he made a confession, which was so written by the person who took it down, that not one word of it could ever be read, and thus his instigators and accomplices could never
151 Louis XIII. be discovered. The regency, during the minority of Louis XIII. was only remarkable for cabals and intrigues of the courtiers. In 1617, the king assumed the government himself, banished the queen mother to Blois, caused her favourite Marshal d'Ancre to be killed, and chose for his minister the famous Cardinal Richelieu. In 1620, a new war broke out between the Catholics and Protestants, which was carried on with the greatest fury on both sides; and we may judge of the spirit which actuated both parties by what happened at Negreplisse, a town in Quercy. This place was besieged by the king's troops, and it was resolved to make an example of the inhabitants. The latter, however, absolutely refused to surrender upon any terms. They defended themselves, therefore, most desperately; and the city being at last taken by storm, they were all massacred, without respect of rank, sex, or age, except ten men. When these were brought into the king's presence, he told them they did not deserve mercy: they answered, that they would not receive it; that the only favour they asked, was to be hanged on trees in their own gardens; which was granted, and the place reduced to ashes. Both parties soon became weary of such a destructive war; and a peace was concluded in 1621, by which the edict of Nantz was confirmed. This treaty, however, was of no long duration. A new war broke out which lasted till the year 1628, when the edict of Nantz was again confirmed; only the Protestants were deprived of all their cautionary towns, and consequently of the power of defending themselves in time to come. This put an end to the civil wars on account of religion in France. Historians say, that in these wars above a million of men lost their lives, that 150,000,000 livres were spent in carrying them on; and that 9 cities, 400 villages, 2000 churches, 2000 monasteries, and 10,000 houses, were burnt or otherwise destroyed during their continuance. The next year, the king was attacked with a slow fever which nothing could allay, an extreme depression of spirits, and prodigious swelling in his stomach and belly. The year after, however, he recovered, to the great disappointment of his mother, who had been in hopes of regaining her power. She was arrested; but found means to escape into Flanders, where she remained during the rest of his reign. Richelieu, by a masterly train of politics, though himself was next to an enthusiast for popery, supported the Protestants of Germany and Gustavus Adolphus against the house of Austria; and after quelling all the rebellions and conspiracies which had been formed against him in France, he died some months before Louis XIII. in 1643.

Louis XIV. surnamed *le Grand*, succeeded to the 152 Louis XIV.
throne when he was only five years of age. During his minority, the kingdom was torn in pieces under the administration of his mother Anne of Austria, by the factions of the great, and the divisions between the court and parliament, for the most trifling causes and upon the most despicable principles. The prince of Condé flamed like a blazing star; sometimes a patriot, sometimes a courtier, and sometimes a rebel. He was opposed by the celebrated Turenne, who from a Protestant had turned Papist. The nation of France was involved at once in civil and domestic wars; but the queen mother having made choice of Cardinal Mazarine for her first minister, he found means to turn the arms even of Cromwell against the Spaniards, and to divide the domestic enemies of the court so effectually among themselves, that when Louis assumed the reins of government into his own hands, he found himself the most absolute monarch that had ever sat upon the throne of France. He had the good fortune, on the death of Mazarine, to put the domestic administration of his affairs into the hands of Colbert, who formed new systems for the glory, commerce, and manufactures of France, all which he carried to a surprising height. The king himself ignorant and vain, was blind to every patriotic duty of a king, promoting the interests of his subjects only that they might the better answer the purposes of his greatness; and by his ambition he embroiled himself with all his neighbours, and wantonly rendered Germany a dismal scene of devastation. By his impolitic and unjust revocation of the edict of Nantz in the year 1685, with the dragooning * the Protestants that followed it, he obliged them to take shelter in England, Holland, and different parts of Germany, where they established the silk manufactories, to the great prejudice of their own country. He was so blinded by flattery, that he arrogated to himself the divine honours paid to the Pagan emperors of Rome. He made and broke treaties for his conveniency: and in the end he raised against himself a confederacy of almost all the other princes of Europe; at the head of which was King William III. of England. He was so well served, that he made head for some years against this alliance; and France seemed to have attained the highest pitch of military glory, under the conduct of those renowned generals Condé and Turenne. (See UNITED PROVINCES). At length, having provoked the English by his repeated infidelities, their arms under the duke of Marlborough, and those of the Austrians under Prince Eugene, rendered the latter part of Louis's life as miserable as the beginning of it was splendid. His reign, from the year 1702 to 1711, was one continued series of defeats and calamities; and he had the mortification of seeing those places taken from him, which, in the former part of his reign, were acquired at the expence of many thousand lives. (See BRITAIN, N° 342, &c.)—Just as he was reduced, old as he was, to the desperate resolution of collecting his people and dying at their head, he was saved by the English Tory ministry deserting

* See *Dragooning*.

France. serting the cause, withdrawing from their allies, and concluding the peace of Utrecht in 1713. See BRITAIN, N° 371, &c.

The last years of Louis XIV. were also embittered by domestic calamities; which, added to those he had already endured of a public nature, impressed him with a deep melancholy. He had been for some time afflicted with a fistula; which, though successfully cut, ever afterwards affected his health. The year before the peace, his only son, the duke of Burgundy, died, together with the duchess and their eldest son; and the only remaining child was left at the point of death. The king himself survived till the month of September 1715; but on the 14th of that month expired, leaving the kingdom to his great grandson Louis, then a minor.

153 Louis XV. 154 Administration of the duke of Orleans.

By the last will of Louis he had devolved the regency during the minority of the young king, upon a council, at the head of which was the duke of Orleans. That nobleman, however, disgusted with a disposition which gave him only a casting vote, appealed to the parliament of Paris, who set aside the will of the late king, and declared him sole regent. His first acts were extremely popular, and gave the most favourable ideas of his government and character. He restored to the parliament the right which had been taken from them of remonstrating against the edicts of the crown, and compelled those who had enriched themselves during the calamities of the former reign to restore their wealth. He also took every method to efface the calamities occasioned by the unsuccessful wars in which his predecessor had engaged; promoted commerce and agriculture; and, by a close alliance with Great Britain and the United Provinces, seemed to lay the foundation of a lasting tranquillity. This happy prospect, however, was soon overcast by the intrigues of Alberoni the Spanish minister, who had formed a design of recovering Sardinia from the emperor, Sicily from the duke of Savoy, and of establishing the Pretender on the throne of Britain. To accomplish these purposes, he negotiated with the Ottoman Porte, Peter the Great of Russia, and Charles XII. of Sweden; the Turks intending to resume the war against the emperor; the two latter to invade Great Britain. But as long as the duke of Orleans retained the administration of France, he found it impossible to bring his schemes to bear. To remove him, therefore, he fomented divisions in the kingdom. An insurrection took place in Brittany; and Alberoni sent small parties into the country in disguise, in order to support the insurgents, and even laid plots to seize the regent himself. All of a sudden, however, the Spanish minister found himself disappointed in every one of his schemes. His partizans in France were put to death; the king of Sweden was killed at Frederickshall in Norway; the Czar, intent on making new regulations, could not be persuaded to make war upon Britain; and the Turks refused to engage in a war with the emperor, from whom they had lately suffered so much. The cardinal, nevertheless, continued his intrigues; which quickly produced a war betwixt Spain on the one part, and France and Britain on the other. The Spaniards, unable to resist the union of two such formidable powers, were soon reduced to the necessity of suing for peace; and the terms were dictated by the regent of France; and of these the dismission of Alberoni the Spanish minister was one. A double marriage was now set on foot: the duke of Orleans gave his own daughter, Mademoiselle Montpensier, to Don Lewis prince of Asturias, while the infanta of Spain was betrothed to her cousin the king of France. From this time the house of Bourbon continued united; both princes being convinced, that it was their interest not to waste their strength in wars against each other.

155 Destruct. project of John Law.

The spirit of conquest having now in a great measure subsided, and that of commerce taken place throughout the world in general, France became the scene of as remarkable a project in the commercial way as ever was known in any country. One John Law, a Scotsman, who had been obliged to leave his own country, laid the plan of a company which might by its notes pay off the debt of the nation, and reimburse itself by the profits. Law had wandered through various parts of Europe, and had successively endeavoured to engross the attention of various courts. The proposal was made to Victor Amadeus king of Sicily; but he dismissed Law with a reply, that "he was not rich enough to ruin himself:" but in France it was looked upon in a more favourable light; the nation being at this time involved in a debt of 200 millions, and the regent, as well as the people in general, very fond of embarking in new schemes. The bank, thus established, proceeded at first with some degree of caution; but having by degrees extended their credit to more than 80 times their real stock, they soon became unable to answer the demands made upon them; so that the company was dissolved the very same year in which it had been instituted. The confusion into which the kingdom was throne by this fatal scheme, required the utmost exertions of the regent to put a stop to it; and scarcely was this accomplished when the king, in 1723, took the government into his own hands. The duke then became minister; but did not long enjoy this post. His irregularities had broken his constitution, and had brought on a number of maladies, under which he in a short time sunk, and was succeeded in his administration by the duke of Bourbon Condé. The king, as we have already remarked, had been married, when very young, to the infanta of Spain, though by reason of his tender years the marriage had never been completed. The princess, however, had been brought to Paris, and for some time treated as queen of France; but as Louis grew up, it was easy to see that he had contracted an inveterate hatred against the intended partner of his bed. The minister, therefore, at last consented that the princess should be sent back; an affront so much resented by the queen her mother, that it had almost produced a war betwixt the two nations.

156 The king takes the government into his own hands.

157 The infanta of Spain sent back.

The dissolution of the marriage of Louis was the last act of Condé's administration; and the procuring of a new match was the first act of his successor Cardinal Fleury. The princess pitched upon was the daughter of Stanislaus Lesczinski, king of Poland, who had been deposed by Charles XII. of Sweden. The princess was destitute of personal charms, but of an amiable disposition; and though it is probable that she never possessed the love of her husband, her excellent qualities could not but extort his esteem; and the birth

158 Marriage with the daughter of Stanislaus king of Poland.

France.

birth of a prince soon after their marriage removed all the fears of the people concerning the succession.

Cardinal Fleury continued the pacific schemes pursued by his predecessors; though they were somewhat interrupted by the war which took place in the year 1733. Notwithstanding the connexion betwixt that monarch and the French nation, however, Fleury was so parsimonious in his assistance, that only 1500 soldiers were sent to relieve Dantzic, where Stanislaus himself resided, and who at that time was besieged by the Russians. This pitiful reinforcement was soon overwhelmed by a multitude of Russians; and Stanislaus was at last obliged to renounce all thoughts of the crown of Poland, though he was permitted to retain the title of king: and that this title might not be merely nominal, the king of France consented to bestow upon him the duchies of Bar and Lorrain; so that, after the death of Stanislaus, these territories were indissolubly united to the dominions of France. Fleury steadily pursued his pacific plans, and the disputes between Spain and England in 1737 very little affected the peace of France; and it must be remembered to his praise, that instead of fomenting the quarrels betwixt the neighbouring potentates, he laboured incessantly to keep them at peace. He reconciled the Genoese and Corsicans, who were at war; and his mediation was accepted by the Ottoman Porte; who at that time carried on a successful war with the emperor of Germany, but made peace with him at the intercession of the cardinal. All his endeavours to preserve the general peace, however, proved at last ineffectual. The death of the emperor Charles VI. in 1740, the last prince of the house of Austria, set all Europe in a flame. The emperor's eldest daughter, Maria Theresa, claimed the Austrian succession, which comprehended the kingdoms of Hungary and Bohemia, the duchy of Silesia, Austrian Suabia, Upper and Lower Austria, Stiria, Carinthia, Carniola; the four forest towns; Burgaw; Brisgaw; the Low Countries; Friuli; Tyrol; the duchy of Milan; and the duchies of Parma and Placentia. Among the many competitors who pretended a right to share, or wholly to inherit, these extensive dominions, the king of France was one. But as he wished not to awaken the jealousy of the European princes by preferring directly his own pretensions, he chose rather to support those of Frederick III. who laid claim to the duchy of Silesia. This brought on the war of 1740; and of which an account is given under the articles BRITAIN and PRUSSIA. It was terminated in 1748 by the treaty of Aix-la-Chapelle; but to this Louis, who secretly meditated a severe vengeance against Britain, only consented, that he might have time to recruit his fleet, and put himself somewhat more upon an equality with this formidable power. But while he meditated great exploits of this kind, the internal tranquillity of the kingdom was disturbed by violent disputes betwixt the clergy and parliaments of France. In the reign of Louis XIV. there had been violent contests betwixt the Jansenists and Jesuits concerning free will and other obscure points of theology; and the opinions of the Jansenists had been declared heretical by the celebrated papal bull named *Unigenitus*; the reception of which was enforced by the king, in opposition to the parliaments, the archbishop of Paris, and the body of the people. The archbishop, with 15 other prelates, protested against it as an infringement of the rights of the Gallican church, of the laws of the realm, and an insult on the rights of the people themselves. The duke of Orleans favoured the bull by inducing the bishops to submit to it; but at the same time stopped a persecution which was going on against its opponents. Thus matters passed over till the conclusion of the peace; a short time after which, the jealousy of the clergy was awakened by an attempt of the minister of state to inquire into the wealth of individuals of their order. To prevent this, they revived the contest about the bull Unigenitus; and it was resolved, that confessional notes should be obtained of dying persons; that these notes should be signed by priests who maintained the authority of the bull; and that, without such notes, no person could obtain a viaticum, or extreme unction. On this occasion the new archbishop of Paris, and the parliament of that city, took opposite sides; the latter imprisoning such of the clergy as refused to administer the sacraments excepting in the circumstances above mentioned. Other parliaments followed the example of that of Paris; and a war was instantly kindled betwixt the civil and ecclesiastical departments of the state. In this dispute the king interfered, forbade the parliaments to take cognizance of ecclesiastical proceedings, and commanded them to suspend all prosecutions relative to the refusal of the sacraments: but instead of acquiescing, the parliaments presented new remonstrances, refused to attend any other business, and resolved that they could not obey this injunction without violating their duty as well as their oath. They cited the bishop of Orleans before their tribunal; and ordered all writings, in which its jurisdiction was disputed, to be burnt by the executioner. By the assistance of the military, they enforced the administration of the sacraments to the sick, and ceased to distribute that justice to the subject for which they had been originally instituted. The king, enraged at their obstinacy, arrested and imprisoned four of the members who had been most obstinate, and banished the remainder to Bourges, Poictiers, and Auvergne; while, to prevent any impediment from taking place in the administration of justice by their absence, he issued letters patent, by which a royal chamber for the prosecution of civil and criminal suits was instituted. The counsellers refused to plead before these new courts; and the king, finding at last that the whole nation was about to fall into a state of anarchy, thought proper to recal the parliament. The banished members entered Paris amidst the acclamations of the inhabitants; and the archbishop, who still continued to encourage the priests in refusing the sacraments, was banished to his seat at Conflans; the bishops of Orleans and Troyes were in like manner banished, and a calm for the present restored to the kingdom.

159 Disputes betwixt the parliaments and clergy.

160 Parliament of Paris banished.

161 New disputes betwixt the king and parliament.

The tranquillity thus established was of no long duration. In the year 1756, the parliaments again fell under the displeasure of their king by their imprudent persecution of those who adhered to the bull Unigenitus. They proceeded so far in this opposition as to refuse to register certain taxes absolutely necessary for the carrying on of the war. By this Louis was so provoked, that he suppressed the fourth and fifth chambers of inquests, the members of which had distinguished

France. guished themselves by their opposition to his will. He commanded the bull Unigenitus to be respected, and prohibited the secular judges from ordering the administration of the sacraments. On this 15 counsellors of the great chamber resigned their offices, and 124 members of the different parliaments followed their example; and the most grievous discontents took place throughout the kingdom. An attempt was made by a fanatic, named *Damien*, to assassinate him; and the king was actually wounded, though slightly, between the ribs, in the presence of his son and in the midst of his guards. The assassin was put to the most exquisite tortures; in the midst of which he persisted, in the most obstinate manner, to declare that he had no intention to kill the king; but that his design was only to wound him, that God might touch his heart, and incline him to restore peace to his dominions, &c. These expressions, which undoubtedly indicated insanity, had no effect on his merciless judges, who consigned him to one of the most horrid deaths the ingenuity or cruelty of man could invent. This attempt, however, seems to have had some effect upon the king; for he soon after banished the archbishop of Paris, who had been recalled, and once more accommodated matters with his parliament.

162 Family compact between France and Spain established.

The unfortunate event of the war of 1755 had brought the nation to the brink of ruin, when Louis implored the assistance of Spain; and on this occasion the celebrated *Family Compact* was signed; by which, with the single exception of the American trade, the subjects of France and Spain are naturalized in both kingdoms, and the enemy of the one sovereign is invariably to be looked upon as the enemy of the other. At that time, however, the assistance of Spain availed very little; both powers were reduced to the lowest ebb, and the arms of Britain were triumphant in every quarter of the globe. See the article BRITAIN.

The peace concluded at Paris in the year 1763, though it freed the nation from a most destructive and bloody war, did not restore its internal tranquillity. The parliament, eager to pursue the victory they had formerly gained over their religious enemies, now directed their efforts against the Jesuits, who had obtained and enforced the bull Unigenitus. That once powerful order, however, was now on the brink of destruction. A general detestation of its members had taken place throughout the whole world. A conspiracy formed by them against the king of Portugal, and from which he narrowly escaped, had roused the indignation of Europe, and this was still farther inflamed by some fraudulent practices of which they had been guilty in France. Le Valette, the chief of their missionaries at Martinico, had, ever since the peace of Aix-la-Chapelle, carried on a very extensive commerce, insomuch that he even aspired at monopolizing the whole West India trade when the war with Britain commenced in 1755. Leonay and Gouffre, merchants at Marseilles, in expectation of receiving merchandise to the value of two millions from him, had accepted of bills drawn by the Jesuits to the amount of a million and a half. Unhappily they were disappointed by the vast number of captures made by the British; in consequence of which they were obliged to apply to the Society of Jesuits at large: but they, either ignorant of their true interest, or too slow in giving assistance, suffered the merchants to stop payment; and thus not only to bring ruin upon themselves, but to involve, as is usual in such cases, a great many others in the same calamity. Their creditors demanded indemnification from the Society at large; and on their refusal to satisfy them, brought their cause before the parliament of Paris. That body, eager to revenge themselves on such powerful adversaries, carried on the most violent persecutions everywhere against them. In the course of these, the volume containing the constitution and government of the order itself was appealed to, and produced in open court. It then appeared, that the order of Jesuits formed a distinct body in the state, submitting implicitly to their chief, who alone was absolute over their lives and fortunes. It was likewise discovered that they had, after a former expulsion, been admitted into the kingdom upon conditions which they had never fulfilled; and to which their chief had obstinately refused to subscribe; consequently that their existence at that time in the nation was merely the effect of toleration. The event was, that the writings of the Jesuits were pronounced to contain doctrines subversive of all civil government, and injurious to the security of the sacred persons of sovereigns: the attempt of Damien against the king was attributed to them, and every thing seemed to prognosticate their speedy dissolution. In this critical moment, however, the king interfered, and by his royal mandate suspended all proceedings against them for a year; a plan of accommodation was drawn up, and submitted to the pope and general of the order: but the latter, by his ill-timed haughtiness, entirely overthrew the hope of reconciliation. The king withdrew his protection, and the parliament redoubled their efforts against them. The bulls, briefs, constitutions, and other regulations of the Society, were determined to be encroachments on authority, and abuses of government; the Society itself was finally dissolved, and its members declared incapable of holding any clerical or municipal offices; their colleges were seized; their effects confiscated, and the order annihilated ever since.

163 Expulsion of the Jesuits.

164 Contention betwixt the king and his parliament.

The parliament having gained this victory, next made an attempt to set bounds to the power of the king himself. They now refused to register an edict which Louis had issued for the continuance of some taxes which should have ended with the war, and likewise to conform to another by which the king was enabled to redeem his debts at an inadequate price. The court attempted to get the edicts registered by force, but the parliaments everywhere seemed inclined to resist to the last. In 1766, the parliament of Brittany refused the crown a gift of 700,000 livres; in consequence of which they were singled out to bear the weight of royal vengeance; but while matters were on the point of coming to extremities, the king thought proper to drop the process altogether, and to publish a general amnesty. The parliaments, however, now affected to despise the royal clemency; which exasperated the king to such a degree, that he ordered the counsellors of the parliament of Brittany (who had refused to resume the functions of which he deprived them) to be included in the list of those who were to be drafted for militia; and those upon whom the lot fell were immediately obliged to join their respective regiments;

France. ments; the rest being employed in forming the city guard. The parliament of Paris remonstrated so freely upon this conduct of the king, that they also fell under his censure; and Louis in the most explicit manner declared, that he would suffer no earthly power to interfere with his will; and the parliaments were for the present intimidated into submission.

The interval of domestic tranquillity which now took place, was employed by the king in humbling the pride of the pope, who refused to recal a brief he had published against the duke of Parma. On this the French monarch reclaimed the territories of Avignon and Venaissin; and while the pontiff denounced his unavailing censures against him, the marquis de Rochecouart, with a single regiment of soldiers, drove out the troops of the pope, and took possession of the territories in question.

165 [Is]land of [C]orsica [re]duced.

A more formidable opposition was made by the natives of the small island of Corsica; the sovereignty of which had been transferred to France by the Genoese, its former masters, on condition that Louis should reinstate them in the possession of the island of Caprala, which the Corsicans had lately reduced. These islanders defended themselves with the most desperate intrepidity; and it was not till after two campaigns, in which several thousands of the bravest troops of France were lost, that they could be brought under subjection.

166 [D]istressed [st]ate of the [na]tion.

The satisfaction which this unimportant conquest might afford to Louis, was clouded by the distress of the nation at large. The East India Company had totally failed, and most of the capital commercial houses in the kingdom were involved in the same calamity. The minister, the duc de Choiseuil, by one desperate stroke, reduced the interest of the funds to one half, and at the same time took away the benefit of the survivorship in the tontines, by which the national credit was greatly affected; the altercation betwixt the king and his parliaments revived, and the dissensions became worse than ever. The duc de Choiseuil attempted in vain to conciliate the differences; his efforts tended only to bring misfortunes upon himself, and in 1771 he was banished by the king, who suspected him of favouring the popular party too much; and this was soon after followed by the banishment of the whole parliament of Paris, and that by the banishment of a number of others; new parliaments being everywhere chosen in place of those who had been expelled. The people where by no means disposed to pay the same regard to these new parliaments that they had done to the old ones; but every appearance of opposition was at last silenced by the absolute authority of the king. In the midst of this plenitude of power, however, which he had so ardently desired, his health daily declined, and the end of his days was evidently at no great distance. As he had all along indulged himself in sensual pleasures to the greatest excess, so they now proved the immediate means of his destruction. His favourite mistress Madame de Pompadour, who for a long time governed him with an absolute sway, had long since been dead, and the king had for some time been equally enslaved by the charms of Madame du Barre. At last even her beauty proved insufficient to excite desire; and a succession of mistresses became necessary to rouse the languid appetites of the king. One of these, who was infected with the smallpox, communicated the disease to the king; who in a short time died of it, notwithstanding all the assistance that could be given him by the physicians. France.

167 Death of Louis XV.

168 Reign of Louis XVI.

The new king Louis XVI. grandson to the former, ascended the throne in the year 1774, in the 20th year of his age; and to secure himself against the disease which had proved fatal to his predecessor, submitted to inoculation, with several others of the royal family. Their quick and easy recovery contributed much to extend that practice throughout the kingdom, and to remove the prejudices which had been entertained against it.

The king had no sooner regained his health, than he applied himself diligently to extinguish the differences which had taken place betwixt his predecessor and the people. He removed those from their employments who had given cause of complaint by their arbitrary and oppressive conduct; and he conciliated the affection of his subjects by removing the new parliaments and recalling the old ones.

But though the prudence of Louis had suggested to him these compliances, he endeavoured still to preserve pure and entire the royal authority. He explained his intentions by a speech in the great chamber of parliament. "The step that he had taken to ensure the tranquillity and happiness of his subjects, ought not (he observed) to invalidate his own authority; and he hoped, from the zeal and attachment of the present assembly, an example of submission to the rest of his subjects. Their repeated resistance to the commands of his grandfather had compelled that monarch to maintain his prerogative by their banishment; and they were now recalled, in the expectation that they would quietly exercise their functions, and display their gratitude by their obedience." He concluded with declaring, "That it was his desire to bury in oblivion all past grievances; that he should ever behold with extreme disapprobation whatever might tend to create divisions and disturb the general tranquillity; and that his chancellor would read his ordinance to the assembly, from which they might be assured he would not suffer the smallest deviation to be made." That ordinance was conceived in the most explicit terms, and was immediately registered by the king's command. The articles of it limited within very narrow bounds the pretensions of the parliament of Paris: The members were forbidden to look upon themselves as one body with the other parliaments of the kingdom, or to take any step, or assume any title, that might tend towards or imply such an union: They were enjoined never to relinquish the administration of public justice, except in cases of absolute necessity, for which the first president was to be responsible to the king; and it was added, that on their disobedience the grand council might replace the parliament, without any new edict for the purpose. They were still, however, permitted to enjoy the right of remonstrating before the registering of any edicts or letters patent which they might conceive injurious to the welfare of the people, provided they preserved in their representations the respect due to the throne. But these remonstrances were not to be repeated; and the parliament, if they proved ineffectual, were to register the edict objected to within a month at farthest from the first day of its being

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being published. They were forbidden to issue any arrets which might excite trouble, or in any manner retard the execution of the king's ordinances; and they were assured by the king himself, at the conclusion of this code for their future conduct, that as long as they adhered to the bounds prescribed, they might depend upon his countenance and protection. In short, the terms on which Louis consented to re-establish the parliaments were such, that they were reduced to mere cyphers, and the word of the king still continued to be the only law in the kingdom. The archbishop of Paris, who had likewise presumed to raise some commotions with regard to the bull Unigenitus, was obliged to submit: and severely threatened if he should afterwards interfere in such a cause.

The final conquest of the Corsicans, who, provoked by the oppression of their governors, had once more attempted to regain their former liberty, was the first event of importance which took place after this restoration of tranquillity: but the kingdom was yet filled with disorder from other causes. A scarcity of corn
1775. happening to take place just at the time that some regulations had been made by M. Turgot the new financier, the populace rose in great bodies, and committed such outrages, that a military force became absolutely necessary to quell them; and it was not till upwards of 500 of these miserable wretches were destroyed that they could be reduced. The king, however, by his prudent and vigorous conduct on this occasion, soon put a stop to all riots, and eminently displayed his clemency as well as prudence in the methods he took for the restoration of the public tranquillity.

169 Humane edict in favour of deserters.

The humanity of Louis was next shown in an edict which he caused to be registered in parliament, sentencing the deserters from his army in future to work as slaves on the public roads, instead of punishing them as formerly with death; and with equal attention to the general welfare of his subjects, he seized the moment of peace to fulfil those promises of economy which on his

170 Suppression of the mousquetaires.

accession he had given to the people. Various regulations took place in consequence; particularly the suppression of the mousquetaires and some other corps, which being adapted more to the parade of guarding the royal person than any real military service, were supported at a great expence, without any adequate return of benefit to the state.

Particular attention was also paid to the state of the marine; and the appointment of M. de Sartine in 1776 to that department did honour to the penetration of the sovereign. That minister, fruitful in resources, and unwearied in his application, was incessantly engaged in augmenting the naval strength of his country; and the various preparations that filled the ports and docks created no small uneasiness to the British court.

The next appointment made by the king was equally happy, and in one respect singular and unprecedented. M. Turgot, though possessed of integrity and industry, had not been able to command the public confidence. On his retreat, M. Clugny, intendant general of Bourdeaux, had been elevated to the vacant post: but he dying in a very short space, M. Taboureau des Reaux was appointed his successor; and the king soon after associated with him in the management of the finances M. Neckar, by birth a Swiss, and by religion a Protestant. That gentleman, in the preceding reign, had been chosen to adjust some differences between the East India Company and the crown; and had discharged his trust in a manner which gained the approbation of both parties. Possessed of distinguished abilities, his appointment would have excited no surprise, had it not been contrary to the constant policy of France, which had carefully excluded the aliens of her country and faith from the controul of her revenue. It now stood forward as a new instance of enlargement of mind and liberality of sentiment; and will to posterity mark the prominent features of the reign of Louis XVI.

France.

171 Appointment of M. Neckar to the direction of the finances.

Although the French monarch was of a pacific disposition, and not destitute of generosity of sentiment; yet his own and the public exultation had been openly and constantly proportioned to the success of the Americans in their contest with Britain: the princes of the blood and the chief nobility were eager to embark in support of the cause of freedom; and the prudence of the king and his most confidential ministers alone restrained their ardour. The fatal events of the former war were still impressed on the mind of Louis; and he could not readily consent to expose his infant marine in a contest with a nation who had so frequently asserted the dominion of the seas, and so lately broken the united strength of the house of Bourbon. At the same time, he was sensible that the opportunity of humbling those haughty islanders, should not be entirely neglected, and that some advantages should be taken of the present commotions in America. Two agents from the United States, Silas Deane and Dr Benjamin Franklin, had successively arrived at Paris: and though all audience was denied them in a public capacity, still they were privately encouraged to hope that France only waited the proper opportunity to vindicate in arms the independence of America. In the mean while, the American cruisers were hospitably received into the French ports: artillery and all kinds of warlike stores were freely sold or liberally granted to the distress of the colonists; and French officers and engineers, with the connivance of government, entered into their service.

172 The French privately assist the Americans in their contest with Britain,

Some changes were about this time introduced into the different departments of state. The conduct of M. Neckar in the finances had been attended with universal approbation; and M. Taboureau des Reaux, his colleague, had resigned his situation, but still retained the dignity of counsellor of state. To afford full scope to the genius of M. Neckar, Louis determined no longer to clog him with an associate: but, with the title of Director General of the Finances, submitted to him the entire management of the funds and revenue of France. In the ensuing year, the count de St Germains, secretary at war, died; and the prince de Montbarey, who had already filled an inferior situation in that department, was now appointed to succeed him.

In the mean time, Louis's negotiations with foreign courts were not neglected. He concluded a new treaty of alliance with Switzerland; vigilantly observed the motions of the different princes of Germany on the death of the elector of Bavaria; and when closely questioned by the English ambassador, Lord Stormont, respecting the various warlike preparations which were diligently

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diligently continued through the kingdom, he replied, That at a time when the seas were covered with English fleets and American cruisers, and when such armies were sent to the New World as had never before appeared there, it became prudent for him also to arm for the security of the colonies and the protection of the commerce of France. The king was not ignorant at the same time, that the remonstrances of Great Britain, and the importunities of the agents of the United States, would soon compel him to adopt some decisive line of conduct. This was hastened by a new event disastrous to Britain; the failure of General Burgoyne's

173 at last openly acknowledge the independence of the United States.

expedition, and the capture of his army. The news of that event was received at Paris with unbounded exultation. M. Sartine, the marine superintendant, was eager to measure the naval strength of France with that of Great Britain; the queen, who had long seconded the applications of the American agents, now espoused their cause with fresh ardour; and the pacific inclinations of Louis being overborne by the suggestions of his ministers and the influence of the queen, it was at length determined openly to acknowledge the independence of the United States.

Dr Franklin and Silas Deane, who had hitherto acted as private agents, were now acknowledged as public ambassadors from those states to the court of Versailles; and a treaty of amity and commerce was signed between the two powers in the month of February 1778. The duke of Noailles, ambassador to the court of London, was in the month of March instructed to acquaint that court with the above treaty. At the same time he declared, that the contracting parties had paid great attention not to stipulate any exclusive advantages in favour of France, and that the United States had reserved the liberty of treating with every nation whatever on the same footing of equality and reciprocity. But this stipulation was treated by the British with contempt; and the recal of Lord Stormont, their ambassador at Versailles, was the signal for the commencement of hostilities.—The events produced by this war are related under the articles AMERICA, BRITAIN, and INDOSTAN. Here our chief business is with domestic transactions, the measures of the cabinet, and the internal economy of the state.

In the year 1780 new changes in the French ministry took place. M. Bertin had resigned the office of secretary of state; the prince de Montbarey had retired from the post of secretary at war, and was succeeded by the marquis de Segur. But the most important removal was that of M. Sartine, who had for

174 Removal of M. Sartine.

several years presided over the marine department, and whose unwearied application and ability had raised the naval power of France to a height that astonished Europe: but his colleagues in the cabinet loudly arraigned a profusion, which would have diverted into one channel the whole resources of the kingdom; and his retreat opened a road to the ambition of the marquis de Castries, who was appointed to supply his place.

This year, the king fixed on the anniversary of his birth day to render it memorable by a new instance of humanity: and he abolished for ever the inhuman custom of *putting the question*, as it was called, by torture; a custom which had been so established by the practice of ages, that it seemed to be an inseparable part of the constitution of the courts of justice in France. At the same time, to defray the charges of war, he continued to diminish his own expenditure; and sacrificing his magnificence to the ease of his subjects, dismissed at once above 400 officers belonging to his court.

175 Dismission of M. Neckar.

Unhappily, however, the popular discontents were excited next year by the dismission of their favourite minister, M. Neckar. He had conceived the arduous but popular project of supporting a war by loans without taxes; and the rigid economy which he had introduced into all the departments of the royal household, and the various resources that presented themselves to his fertile genius, had supported him amidst the difficulties that attended this system. But his austerity of temper had not rendered him equally acceptable to the sovereign and his subjects; and the repeated reforms he had recommended were represented as inconsistent with the dignity of the crown: he was therefore in 1781 dismissed from his office of comptroller-general; and M. Joli de Fleuri, counsellor of state, was appointed to that important department. The defeat of the count de Grasse happened next year, and impressed the kingdom with general grief and consternation. Immense preparations were, however, made for the operations of 1783; and in conjunction with the courts of Madrid and the Hague, Louis was determined this year to make the most powerful efforts to bring the war to a conclusion. But in the midst of these preparations, the voice of peace was again heard; and Louis was induced

176 Peace concluded.

to listen to the proffered mediation of the two first potentates in Europe, the emperor of Germany and the empress of Russia. The count de Vergennes, who still occupied the post of secretary of foreign affairs, was appointed to treat with Mr Fitzherbert the British minister at Brussels, but who had lately proceeded to Paris to conduct this important negotiation. The way was already smoothed for the restoration of public tranquillity, by provisional articles signed at the conclusion of the last year between the states of America and Great Britain, and which were to constitute a treaty of peace finally to be concluded when that between France and Great Britain took place. Preliminary articles were accordingly agreed upon and signed at Versailles: these were soon after succeeded by a definitive treaty; and France, throughout her extensive dominions, beheld peace once more established. Though the late war had been attended by the most brilliant success, and the independence of America seemed to strike deep at the source of her rival's power, yet France herself had not been entirely free from inconvenience. The retreat of M. Neckar, had, as we have already observed, diminished the public confidence; three different persons who had since transiently occupied his post, increased the jealousies of the people;

177 Of the Caisse d'Escompte.

and the failure of the celebrated Caisse d'Escompte completed the universal consternation.

That bank had been established in the year 1776. The plan of it was formed by a company of private adventurers, and its capital was fixed at 500,000l. sterling. The professed design of the Company was to discount bills at short dates, at the rate of four per cent. per annum: but as this interest could never be an equivalent for the capital sunk by the proprietors, they were intrusted with the additional power of issuing notes to the amount of their capital, which, as they were

France. were capable at any time of being converted into specie, might be often voluntarily taken by their customers from mere convenience. The reputation of the bank soon caused its stock to sell above par: and its credit was still at the highest, when to the astonishment of the nation it suddenly stopped payment on the 2d of October 1783. The cause assigned was an uncommon scarcity of specie: But the public suspected that the failure arose from a loan secretly made to government; and what confirmed the suspicion was, that government about the same time stopped payment of the bills drawn upon them by their army in America.

Whatever was the cause of this event, the king was prevailed on to extend his protection to the Company. By four successive edicts the banks in Paris were ordered to receive the notes of the Caisse d'Escompte as currency; and a lottery with a stock of one million sterling, redeemable in eight years, being established, the tickets were made purchasable in notes of the Caisse d'Escompte. By these expedients the public confidence in that bank was revived, its business increased, and its stock rose to above double the original subscription; the bills from America were at the same time put in a train of payment, and public credit was restored throughout the kingdom. Some compensation also for the expences that had been incurred during the late war, was drawn from a treaty with the United States of America. These engaged to reimburse France in the sum of 18 millions of livres, which had been advanced in the hour of their distress; and Louis consented to receive the money, as more convenient to the States, in the space of 12 years, by 12 equal and annual payments.

178 Treaty between France and Holland.

The general peace was soon after followed by a particular treaty between France and Holland, which was effected with great address by the Count de Vergennes. It included all the principles which can serve to cement in the closest union distinct nations under distinct governments; and by which they may mutually participate, in peace or in war, of good or of evil; and in all cases administer the most perfect aid, counsel, and succour to each other. It also prescribed, if their united good offices for the preservation of peace should prove ineffectual, the assistance they were to afford each other by sea and land. France was to furnish Holland with 10,000 effective infantry, 2000 cavalry, with 12 ships of the line and 6 frigates. Their high Mightinesses, on the other side, in case of a marine war, or that France should be attacked by sea, were to contribute to her defence six ships of the line and three frigates; and in case of an attack on the territory of France, the States General were to have the option of furnishing their land contingent either in money or troops, at the estimate of 5000 infantry and 1000 cavalry. Further, If the stipulated succours should be insufficient for the defence of the party attacked, or for procuring a proper peace, they engaged to assist each other with all their forces, if necessary; it being however agreed that the contingent of troops to be furnished by the States General should not exceed 20,000 infantry and 4000 cavalry. It was further added, that neither of the contracting powers should disarm, or make or receive proposals of peace or truce, without the consent of the other: they promised also not to contract any future alliance or engagement whatever, directly or indirectly, contrary to the present treaty; and on any treaties or negotiations being proposed which might prove detrimental to their joint interest, they pledged their faith to give notice to each other of such proposals as soon as made.

Thus was Holland now converted into the firm ally of that power against whose encroaching spirit she had formerly armed the most powerful kingdoms of Europe; while France having asserted the independence of America against Great Britain, and having converted an ancient and formidable foe into an useful friend, seemed to have attained an influence over the nations of the earth that she had never before been possessed of.

But however exalted her present situation might appear, the seeds of future commotion were already apparent to an attentive observer. The applause that had attended the parliament of Paris in their struggles with the late king might be considered as the first dawn of freedom; the language of that assembly had boldly inculcated to their countrymen their natural rights, and taught them to look with a less enraptured eye on the lustre that encompassed the throne. The war in America had contributed to enlarge the political ideas of the French: they had on that occasion stood forth as the champions of liberty, in opposition to regal power; and the officers, who had acted on that conspicuous theatre, accustomed to think and speak without restraint, on their return imparted to the provinces of France the flame of freedom which had been kindled in the wilds of America. From that moment the French, instead of silently acquiescing under the edicts of their sovereign, canvassed each action with bold and rigid impartiality; while the attachment of the army, which has ever been considered as the sole foundation of despotism, gave way to the noble enthusiasm of liberty.

179 Consequence to France from her interference between Britain and her colonies.

We have already noticed the public dissatisfaction that had attended the dismission of M. Neckar; his transient successor, M. de Fleury, had retired from the management of the finances in 1783, and the more transient administration of M. d'Ormesson had expired in the same year that gave it birth. On his retreat, M. de Calonne, who had successively filled with acknowledged reputation the office of intendant of Mentz, and afterwards of the provinces of Flanders and Artois, was nominated to the post of comptroller-general. This gentleman, flexible and insinuating, eloquent in conversation, and polished in his manners, fertile in resources and liberal in the disposal of the public money, soon rendered himself acceptable to the sovereign. But he did not enter upon this new and arduous station favoured by the breath of popularity: he was reported to be more able than consistent, and not to have tempered the ardour of his spirit by the severity of deep research; and the people, amidst repeated loans, regretted that severe simplicity which had characterized the administration of M. Neckar.

180 Appointment and measures of M. de Calonne.

It was the bold and judicious measures of Calonne, however, that restored credit to the Caisse d'Escompte, which had stopped payment a few weeks before his accession. His next measure, in 1784, the establishment of the Caisse d'Amortissement, or sinking fund, was entitled to a still higher degree of applause. The plan of that fund was simple and moderate: It was to pay annually by government, into the hands of a board set apart

France. apart for that purpose, the entire interest of the national debts, whether in stock or annuities, together with an additional sum of 120,000l. The annuities that would be extinguished every year were estimated at 50,000l.; and in that proportion, the sum set apart for the redemption of the national debt would annually increase. The operation of this new fund was limited to the term of 25 years; and during that term the annual receipt of the Caisse d' Amortissement is declared unalterable, and incapable of being diverted to any other object.

The principal measure of the next year was the establishment of a new East India Company, (the constitutions of which have been already detailed: see COMPANY);—a measure not equally commendable with the preceding, and which did not fail to excite violent complaints. The time, however, was now approaching, when the necessities of the state would compel him to measures still more unpopular, and destined to undergo a severer scrutiny. Although peace had been re-established throughout Europe for three years, yet the finances of France seemed scarce affected by this interval of tranquillity, and it was found requisite to close every year with a loan. The public expenditure of 1785 might probably seem to sanction this measure. It had been thought proper to fortify Cherbourg upon a large and magnificent scale; the claim of the emperor to the navigation of the Scheldt had obliged the French to increase their land forces, either to form a respectable neutrality, or to assist effectually their Dutch allies; and the marquis de Castries, fond of war, and profuse in his designs, had not suffered the navy, which M. Sartine had surrendered into his hands, to decline during the interval of peace. The treaty of commerce concluded in the year 1786 with Great Britain was a new source of discontent.—Though regarded by the English manufacturers as far from advantageous, it excited in France still louder murmurs. It was represented as likely to extinguish those infant establishments, which were yet unable to vie with the manufactures of England that had attained to maturity; and the market that it held out for the wines and oils of France was passed over in silence, while the distress of the artisan was painted in the most striking colours. But when the edict for registering the loan at the conclusion of the last year, and which amounted to the sum of three millions three hundred and thirty thousand pounds, was presented to the parliament of Paris, the murmurs of the people, through the remonstrances of that assembly, assumed a more legal and formidable aspect. The king, however, signified to the select deputation that were commissioned to convey to him their remonstrances, that he expected to be obeyed without further delay. The ceremony of the registering accordingly took place on the next day; but it was accompanied with a resolution, importing, "that public economy was the only genuine source of abundant revenue, the only means of providing for the necessities of the state, and restoring that credit which borrowing had reduced to the brink of ruin."

The king was no sooner informed of this step, than he commanded the attendance of the grand deputation of parliament; when he erazed from their records the resolution that had been adopted; and observed, that though it was his pleasure that the parliament should communicate, by its respectful representations, whatever might concern the good of the public, yet he never would allow them so far to abuse his clemency as to erect themselves into the censors of his government. At the same time, more strongly to mark his displeasure at their expostulations, he superseded one of their officers, who had appeared most active in forwarding the obnoxious resolution. France.

M. de Calonne, however, though gratified by the approbation of his sovereign, could not but feel himself deeply mortified by the opposition of the parliament. His attempts to conciliate that assembly had proved ineffectual: and he experienced their inflexible aversion at the critical juncture when their acquiescence might have proved of the most essential service. An anxious inquiry into the state of the public finances had convinced him that the expenditure by far exceeded the revenue. In this situation, to impose new taxes was impracticable; to continue the method of borrowing was ruinous; to have recourse only to economical reforms, would be found wholly inadequate; and he hesitated not to declare, that it would be impossible to place the finances on a solid basis, but by the reformation of whatever was vicious in the constitution of the state.

To give weight to this reform, M. de Calonne was sensible that something more was necessary than the royal authority; he perceived that the parliament was neither a fit instrument for introducing a new order into public affairs, nor would submit to be a passive machine for sanctioning the plans of a minister, even if those plans were the emanations of perfect wisdom. Though originally a body of lawyers, indebted for their appointments to the king, there was not an attribute of genuine legislative assembly but what they seemed desirous to engross to themselves; and they had been supported in their pretensions by the plaudits of the people, who were sensible that there was no other body in the nation that could plead their cause against royal or ministerial oppression. To suppress, therefore, the only power of controul that remained, and to render the government more arbitrary, was deemed too perilous a measure: yet to leave the parliament in the full possession of their influence, an influence that the minister was convinced would be exerted against him, was at once to render his whole system abortive.

In this dilemma, the only expedient that suggested itself was to have recourse to some other assembly, more dignified and solemn in its character, and which should in a greater degree consist of members from the various orders of the state and the different provinces of the kingdom. This promised to be a popular measure; it implied a deference to the people at large, and might be expected to prove highly acceptable. But the true and legitimate assembly of the nation, the States General, had not met since the year 1614; nor could the minister flatter himself with the hope of obtaining the royal assent to a meeting which a despotic sovereign could not but regard with secret jealousy. Another assembly had occasionally been substituted in the room of the States General: this was distinguished by the title of the *Notables*; and consisted of a num- 181 Assembly of the Notables.

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France.

ber of persons from all parts of the kingdom, chiefly selected from the higher orders of the state, and nominated by the king himself. This assembly had been convened by Henry IV. again by Louis XIII. and was now once more summoned by the authority of Louis XVI.

The writs for calling them together were dated on the 29th of December 1786; and they were addressed to seven princes of the blood, nine dukes and peers of France, eight field mareschals, twenty-two nobles, eight counsellors of state, four masters of requests, eleven archbishops, and bishops, thirty-seven of the heads of the law, twelve deputies of the *pays d'etats*, the lieutenant civil, and twenty-five magistrates of the different towns of the kingdom. The number of members was 144; and the 29th of January 1787 was the period appointed for their meeting.

Upon the arrival of the notables at Paris, however, the minister found himself yet unprepared to submit his system to their inspection, and postponed the opening of the council to the 7th of February. A second delay to the 14th of the same month was occasioned by the indisposition of M. de Calonne himself, and that of the count de Vergennes president of the council of finance and first secretary of state; and a third procrastination was the necessary result of the death of the count on the day previous to that fixed for the opening of the meeting. He was succeeded in the department of foreign affairs by the count de Montmorin, a nobleman of unblemished character. But his loss at this critical juncture was severely felt by M. de Calonne; he alone, of all the ministers, having entered with warmth and sincerity into the plans of the comptroller general. The chevalier de Miromesnil, keeper of the seals, was avowedly the rival and enemy of that statesman. The mareschal de Castries, secretary for the marine department, was personally attached to M. Neckar; and the baron de Breteuil, secretary for the household, was the creature of the queen, and deeply engaged in what was called the Austrian system.

182 Splendid project of M. de Calonne.

It was under these difficulties that M. de Calonne, on the 22d of February, first met the assembly of the notables, and opened his long-expected plan. He began by stating, that the public expenditure had for centuries past exceeded the revenue, and that a very considerable deficiency had of course existed; that the Missisippi scheme of 1720 had by no means, as might have been expected, restored the balance; and that under the economical administration of Cardinal Fleury the deficit still existed; that the progress of this derangement under the last reign had been extreme; the deficiency amounting to three millions sterling at the appointment of the Abbé Terray; who, however, reduced it to one million six hundred and seventy-five thousand pounds; it decreased a little under the short administrations that followed, but rose again in consequence of the war, under the administration of M. Neckar; and at his own accession to office, it was three millions three hundred and thirty thousand pounds.

In order to remedy this growing evil, M. Calonne recommended a territorial impost, in the nature of the English land tax, from which no rank or order of men were to be exempted; and an inquiry into the possessions of the clergy, which hitherto had been deemed sacred from their proportion of the public burdens: the various branches of internal taxation were also to undergo a strict examination; and a considerable resource was presented in mortgaging the demesne lands of the crown.

The very necessity for these reforms was combated with a degree of boldness and force of reasoning that could not fail of deeply impressing the assembly; and instead of meeting with a ready acquiescence, the comptroller general was now launched into the boundless ocean of political controversy. M. Neckar, previous to his retirement, had published his Compte rendu au Roy, in which France was represented as possessing a clear surplus of 425,000 pounds sterling: this performance had been read with avidity, and probably contributed to estrange from the author the royal countenance; but the credit of it was ably vindicated by M. de Brienne archbishop of Thoulouse.

183 Opposed by Mirabeau and the bishop of Thoulouse.

M. de Calonne met with a still more formidable adversary in the count de Mirabeau. This extraordinary man, restless in his disposition, licentious in his morals, but bold, penetrating, and enterprising, had occasionally visited every court in Europe. He had been admitted at one time to the confidence of the minister; and had been directed, though in no ostensible character, to observe at Berlin, the disposition of the successor of the great Frederick. In this capacity he was frequently exposed to neglect and disappointment; his letters were often left unanswered; disgust succeeded to admiration; and he who had entered the Prussian court the intimate friend, returned to Paris the avowed enemy, of M. de Calonne: While the archbishop arraigned the understanding, the count impeached the integrity, of the comptroller general.

The eloquence of M. de Calonne, however, might have successfully vindicated his system and reputation against the calculations of Brienne, and the invectives of Mirabeau; but he could not support himself against the influence of the three great bodies of the nation.

184 and by the principal nobility, clergy, and magistrates.

The ancient nobility and the clergy had ever been free from all public assessments; and had the evil gone no farther, it might have been still perhaps borne with patience; but through the shameful custom of selling patents of nobility, such crowds of new noblesse started up, that every province in the kingdom was filled with them. The first object with those who had acquired fortunes rapidly, was to purchase a patent; which, besides gratifying their vanity, afforded an exemption to them and their posterity from contributing proportionably to the exigencies of the state; the magistracies likewise throughout the kingdom enjoyed their share of the exemptions; so that the whole weight of the taxes fell on those who were least able to bear them.

The minister's design, then, of equalizing the public burdens, and by rendering the taxes general diminishing the load borne by the lower and most useful classes of people, though undoubtedly great and patriotic, at once united against him the nobility, the clergy, and the magistracy; and the event was such as might be expected: the intrigues of those three bodies raised against him so loud a clamour, that finding it impossible to stem the torrent, he not only resigned his place

place on the 12th of April, but soon after retired to England from the storm of persecution.

185 ...on ...ich M. Calonne ...gns.

In the midst of these transactions at home, Louis's attention was also called to the state of affairs in the republic of Holland, his new and close ally. The prince of Orange had been stripped of all authority by the aristocratic party; and, retiring from the Hague, maintained the shadow of a court at Nimeguen. His brother-in-law, however, the new king of Prussia, exerted his endeavours to promote the interests of the stadtholder; and, having offered, in concert with France, to undertake the arduous task of composing the differences which distracted the republic, the proposal was received with apparent cordiality by the court of Versailles. At the same time it could scarce be expected that France would become the instrument of restoring the prince of Orange to that share of power which he had before occupied, and thus abandon one of the longest and most favourite objects of her policy, the establishing a supreme and permanent controul in the affairs of Holland. In fact, the conditions which were framed by the Louvestein faction, as the basis of reconciliation, were such as plainly indicated their design to reduce the influence and authority of the stadtholder within very narrow limits. On his renouncing his right of filling up the occasional vacancies in the town senates, he was to be restored to the nominal office of captain general: but he was to be restrained from marching the troops into or out of any province, without leave from the respective provinces concerned; and he was also to subscribe to a resolution passed some time before by the senate of Amsterdam, that the command should at all times be revocable at the pleasure of the states. Had the prince acquiesced in these preliminaries, France would have completely attained the object of her long negotiations, and by means of the Louvestein faction have acquired the ascendency that she had repeatedly sought in the councils of Holland. But under the difficulties that surrounded him, the prince of Orange was admirably supported and assisted by the genius, the spirit, and the abilities of his consort: she firmly rejected every measure tending to abridge any rights that had been attached to the office of stadtholder; and M. de Rayneval, the French negotiator, having in vain endeavoured to overcome her resolution, broke off the correspondence between the Hague and Nimeguen, and returned to Paris about the middle of January 1787.

186 ...turban... in Hol...d.

187 Att...pts of t... Fre...h to sup...t the rep...ican part...

But the republican party were totally disappointed in their hopes from France. The court of Versailles had indeed long trusted to the natural strength of this party, and had been assiduous during the whole summer in endeavouring to second them by every species of succours that could be privately afforded. Crowds of French officers arrived daily in Holland; and either received commissions in the service of the states, or acted as volunteers in their troops. Several hundreds of tried and experienced soldiers were selected from different regiments; and being furnished with money for their journey, and assurances of future favour, were despatched in small parties to join the troops, and help to discipline the burghers and volunteers. A considerable corps of engineers were also directed to proceed silently and in disguise towards Amsterdam, and to assist in strengthening the works of that city. These aids, which might have proved effectual had the contest been confined to the states of Holland and the stadtholder, were overwhelmed in the rapid invasion of the Prussians; and the court of Berlin had taken its measures with so much celerity, and the situation of the republicans was already become so desperate, that it was doubtful whether their affairs could be restored by any assistance that France was capable of immediately administering. Yet on Great Britain fitting out a strong squadron of men of war at Portsmouth to give confidence to the operations of the king of Prussia, the court of Versailles also sent orders to equip 16 sail of the line at Brest, and recalled a small squadron which had been commissioned on a summer's cruise on the coast of Portugal. But in these preparations Louis seemed rather to regard his own dignity, than to be actuated by any hopes of effectually relieving his allies. All opposition in Holland might be already considered as extinguished. The states assembled at the Hague had officially notified to the court of Versailles, that the disputes between them and the stadtholder were now happily terminated; and as the circumstances which gave occasion for their application to that court no longer existed, so the succours which they had then requested would now be unnecessary.

Under these circumstances, France could only wish to extricate herself from her present difficulty with honour. She therefore readily listened to a memorial from the British minister at Paris: who proposed, in order to preserve the good understanding between the two crowns, that all warlike preparations should be discontinued, and that the navies of both kingdoms should be again reduced to the footing of a peace establishment. This was gladly acceded to by the court of Versailles; and that harmony which had been transiently interrupted between the two nations was restored.

188 Domestic concerns of France.

Though the French king could not but sensibly feel the mortification of thus relinquishing the ascendency which he had attained in the councils of Holland, the state of his own domestic concerns and the internal situation of his kingdom furnished matter for more serious reflection. The dismission of M. de Calonne had left France without a minister, and almost without a system; and though the king bore the opposition of the notables with admirable temper, yet the disappointment that he had experienced sunk deep into his mind. Without obtaining any relief for his most urgent necessities, he perceived too late that he had opened a path to the restoration of the ancient constitution of France, which had been undermined by the crafty Louis XI. and had been nearly extinguished by the daring and sanguinary counsels of Richelieu under Louis XIII. The notables had indeed demeaned themselves with respect and moderation, but at the same time they had not been deficient in firmness. The appointment of the archbishop of Thoulouse, the vigorous adversary of M. de Calonne, to the office of comptroller-general, probably contributed to preserve the appearance of good humour in that assembly; yet the

189 Assembly of the Notables dissolved.

France. the proposed territorial impost, or general land tax, which was an object so ardently coveted by the court, was rejected. Louis, therefore, deprived of any further hope of rendering the convention subservient to his embarrassments, determined to dissolve the assembly; which he accordingly did, with a very moderate and conciliatory speech to the members on their dismission.

190
Refusal of the parliament to register the new taxes.

Thus disappointed of the advantage which he had flattered himself he would have drawn from the acquiescence of the notables, the king was obliged now to recur to the usual mode of raising money by the royal edicts; among the measures proposed for which purpose were the doubling of the poll-tax, the re-establishment of the third twentieth, and a stamp duty. But the whole was strongly disapproved by the parliament of Paris; and that assembly, in the most positive terms, refused to register the edict. Louis was obliged to apply, as the last resort, to his absolute authority; and, by holding what is called *a bed of justice*, compelled them to enrol the impost.

The parliament, though defeated, were far from subdued; and on the day after the king had held his bed of justice, they entered a formal protest against the edict; declaring, "that it had been registered against their approbation and consent, by the king's express command; that it neither ought nor should have any force; and that the first person who should presume to attempt to carry it into execution, should be adjudged a traitor, and condemned to the galleys."—This spirited declaration left the king no other alternative, than either proceeding to extremities in support of his authority, or relinquishing for ever after the power of raising money upon any occasion without the consent of the parliament. Painful as every appearance of violence must have proved to the mild disposition of Louis, he could not consent to surrender, without a struggle, that authority which had been so long exercised by his predecessors. Since the commencement of the present discontents, the capital had been gradually filled with considerable bodies of troops; and about a week after the parliament had entered the protest, an officer of the French guards, with a party of soldiers, went at break of day to the house of each individual member, to signify to him the king's command, that he should immediately get into his carriage, and proceed to Troyes, a city of Champagne, about 70 miles from Paris, without writing or speaking to any person out of his own

191
The members banished.

house before his departure. These orders were served at the same instant; and before the citizens of Paris were acquainted with the transaction, their magistrates were already on the road to their place of banishment.

Previous to their removal, however, they had presented a remonstrance on the late measures of government, and the alarming state of public affairs. In stating their opinions on taxes, they declared, that neither the parliaments, nor any other authority, excepting that of the three estates of the kingdom collectively assembled, could warrant the laying of any permanent tax upon the people; and they strongly enforced the renewal of those national assemblies, which had rendered the reign of Charlemagne so great and illustrious.

This requisition of the parliaments to re-establish the national council, or states general, was the more honourable, as the former assemblies must have sunk under the influence of the latter, and returned to their original condition of mere registers and courts of law. The confidence and attachment of the people of consequence rose in proportion to this instance of disinterestedness; their murmurs were openly expressed in the streets of the capital, and the general dissatisfaction was augmented by the stop that was put to public business by the exile of the parliament.

The cabinet at the same time was apparently weak, disunited, and fluctuating: and continual changes took place in every department of the state. Louis, averse to rigorous counsels, wished to allay the growing discontent by every concession that was consistent with his dignity; but it was generally believed, that the queen strongly dissuaded him from any step that might tend to the diminution of the royal authority. The influence of that princess in the cabinet was undoubtedly great: but the popularity which once had accompanied her was no more; and some imputations of private levity, which had been rumoured through the capital, were far from rendering her acceptable to the majority of the people; while the Count d'Artois, the king's brother, who had expressed himself in the most unguarded terms against the conduct of parliament, stood exposed to all the consequences of popular hatred.

Nor was it only in the capital that the flame of liberty once more burst forth; it blazed with equal strength in the provincial parliaments. Among various instances of this nature, the parliament of Grenoble passed a decree against *lettres de cachet*, the most odious engine of arbitrary power; and declared the execution of them within their jurisdiction, by any person, and under whatever authority, to be a capital crime.

The king had endeavoured to soothe the Parisians by new regulations of economy, and by continual retrenchments in his household: but these instances of attention, which once would have been received with the loudest acclamations, were now disregarded under their affliction for the absence of their parliament. His majesty, therefore, in order to regain the affections of his subjects, consented to restore that assembly; abandoning at the same time the stamp duty, and the territorial impost, which had been the sources of dispute. 192 Recalled.

These measures were, however, insufficient to establish harmony between the court and the parliament. The necessities of the state still continued; nor could the deficiency of the revenue be supplied but by extraordinary resources, or a long course of rigid frugality. About the middle of November 1787, in a full meeting of the parliament, attended by all the princes of the blood and the peers of France, the king entered the assembly, and proposed two edicts for their approbation: one was for a new loan of 450 millions, near 19 millions sterling: the other was for the re-establishment of the Protestants in all their ancient civil rights; a measure which had long been warmly recommended by the parliament, and which was probably now introduced to procure a better reception to the loan.

On

On this occasion, the king delivered himself in a speech of uncommon length, filled with professions of regard for the people, but at the same time strongly expressive of the obedience he expected to his edicts. Louis probably imagined, that the dread of that banishment from which the members had been so lately recalled would have ensured the acquiescence of the assembly; but no sooner was permission announced for every member to deliver his sentiments, than he was convinced that their spirits remained totally unsubdued. An animated debate took place, and was continued for nine hours; when the king, wearied by perpetual
193 ...ose the ...t for a ...
opposition, and chagrined at some freedoms used in their debates, suddenly rose and commanded the edict to be registered without farther delay. This measure was most unexpectedly opposed by the duke of Orleans, first prince of the blood; who, considering it as an infringement of the rights of parliament, protested against the whole proceedings of the day as being thereby null and void. Though Louis could not conceal his astonishment and displeasure at this decisive step, he contented himself with repeating his orders; and immediately after, quitting the assembly, retired to Versailles. On the king's departure, the parliament confirmed the protest of the duke of Orleans; and declared, that as their deliberations had been interrupted, they considered the whole business of that day as of no effect.

It was not to be supposed that Louis would suffer so bold an attack on his power with impunity. Accordingly, a letter was next day delivered to the duke of Orleans, commanding him to retire to Villars Cotterel, one of his seats, about 15 leagues from Paris, and to receive no company there except his own family;
194 Duke of Orleans and two members banished.
at the same time, the Abbé Sabatiere and M. Freteau, both members of the parliament, and who had distinguished themselves in the debate, were seized under the authority of lettres de cachet, and conveyed, the first to the castle of Mont St Michael in Normandy, the last to a prison in Picardy.
195 Strong remonstrances of the parliament.
This act of despotism did not fail immediately to rouse the feelings of the parliament. On the following day they waited on the king, and expressed their astonishment and concern that a prince of the blood royal had been exiled, and two of their members imprisoned, for having declared in his presence what their duty and consciences dictated, and at a time when his majesty had announced that he came to take the sense of the assembly by a plurality of voices. The answer of the king was reserved, forbidding, and unsatisfactory; and tended to increase the resentment of the parliament. At the same time, it did not prevent them from attending to the exigencies of the state; and convinced of the emergency, they consented to register the loan for 450 millions of livres, which had been the source of this unfortunate difference. This concession contributed to soften the mind of the king, and the sentence of the two magistrates was in consequence changed from imprisonment to exile; M. Freteau being sent to one of his country seats, and the Abbé Sabatiere to a convent of Benedictines.

The parliament, however, was not to be soothed by that measure to give up the points against which they had originally remonstrated. In a petition conceived with freedom, and couched in the most animated language, they boldly reprobated the late acts of arbitrary violence, and demanded the entire liberation of the persons against whom they had been exerted. We have already noticed the fluctuating counsels of the court of Versailles; and that Louis, as often as he was left to pursue his own inclinations, adopted measures of reconciliation. On the present occasion, in 196 Duke of Orleans recalled.
the beginning of the year 1788, he recalled the duke of Orleans to court, who soon after obtained leave to retire to England; and he permitted the return of the Abbé Sabatiere and M. Freteau to the capital.

The parliament, however, had not confined their demands to the liberation of those gentlemen; but had also echoed the remonstrances of the parliament of Grenoble, and had loudly inveighed against the execution of *lettres de cachet*. These repeated remonstrances, mingled with personal reflections, seconded most probably the suggestions of the queen, and Louis was once more instigated to measures of severity. Mess. 197 New remonstrances.
d'Espremenil and Monsambert, whose bold and pointed harangues had pressed most closely on the royal dignity, were doomed to experience its immediate resentment. While a body of armed troops surrounded the hotel in which the parliament were convened, Colonel Degout entered the assembly, and secured the persons of the obnoxious members, who were instantly conducted to different prisons. This new instance of arbitrary violence occasioned a remonstrance from parliament, which in boldness far exceeded all the former representations of that assembly. They declared they were now more strongly confirmed, by every proceeding, of the entire innovation which was aimed at in the constitution. "But, Sire," added they, "the French nation will never adopt the despotic measures to which you are advised, and whose effects alarm the most faithful of your magistrates; we shall not repeat all the unfortunate circumstances which afflict us; we shall only represent to you with respectful firmness, that the fundamental laws of the kingdom *must* not be trampled upon, and that *your authority can only be esteemed so long as it is tempered with justice.*"

Language so pointed and decisive, and which assert- 198 Assembly of the Notables.
ed the controlling power of the laws above the regal authority, could not fail of seriously alarming the king; and with a view to diminish the influence of parliament, it was determined again to convene the notables. Accordingly, about the beginning of May, Louis appeared in that assembly: and after complaining of the excesses in which the parliament of Paris had indulged themselves, and which had drawn down his reluctant indignation on a few of the members, he declared his resolution, instead of annihilating them as a body, to recal them to their duty and obedience by a salutary reform. M. de la Moignon, as keeper of the seals, then explained his majesty's pleasure to establish a *cour plenier* or supreme assembly, to be composed of princes of the blood, peers of the realm, great officers of the crown, the clergy, mareschals of France, governors of provinces, knights of different orders, a deputation of one member from every parliament, and two members from the chambers of council, and to be summoned as often

France.

often as the public emergency, in the royal opinion, should render it requisite.

If the assembly of the notables listened in silent deference to the project of their sovereign, the parliament of Paris received it with every symptom of aversion.

199 Opposition to the king's proposals.

That body strongly protested against the establishment of any other tribunal; and declared their final resolution not to assist at any deliberations in the supreme assembly which his majesty prepared to institute. A more unexpected mortification occurred to the king in the opposition of several peers of the realm; these expressed their regret at beholding the fundamental principles of the constitution violated; and while they were lavish in the professions of attachment to the person of their sovereign, concluded with apologizing for not entering on those functions assigned them in the plenary court, as being inconsistent with the true interests of his majesty, which were inseparable from those of the nation.

The flame quickly spread throughout the more distant provinces; at Rennes in Brittany, and Grenoble in Dauphiné, the people broke out into acts of the most daring outrage. In the latter city several hundred of the inhabitants perished in a conflict with the military; they yet maintained their ground against the regulars; and the commanding officer, at the entreaties of the first president, readily withdrew his troops from a contest into which he had entered with reluctance. The different parliaments of the kingdom at the same time expressed their feelings in the most glowing language; and strongly urged the necessity of calling together the states general, the lawful council of the kingdom, as the only means of restoring the public tranquillity.

Louis now plainly, saw, that a compliance with the public wishes for the re-establishment of the states general was absolutely necessary, in order to avoid the calamities of a civil war, which impended upon his refusal. In that event he must have expected to have encountered the majority of the people, animated by the exhortations and example of their magistrates; the peers of the realm had expressed the strongest disapprobation of his measures; nor could he even depend any longer on the support of the princes of his blood: but what afforded most serious matter of alarm was the spirit lately displayed among the military, who, during the disturbances in the provinces, had reluctantly been brought to draw their swords against their countrymen, and many of whose officers so recently engaged in establishing the freedom of America, publicly declared their abhorrence of despotism.

It was, not, however, till after many a painful struggle that Louis could resolve to restore an assembly, whose influence must naturally overshadow that of the crown, and whose jurisdiction would confine within narrow limits the boundless power he had inherited from his predecessor. In the two preceding reigns the states general had been wholly discontinued; and though the queen regent, during the troubles which attended the minority of Louis XIV. frequently expressed her intention of calling them together, she was constantly dissuaded by the representations of Mazarin. It is probable that the present monarch still flattered himself with the hope of being able to allure the members of that assembly to the side of the court; and having employed them to establish some degree of regularity in the finances, and to curb the spirit of the parliament, that he would again have dismissed them to obscurity.

200 Arret for summoning the states general.

Under these impressions an arret was issued in August, fixing the meeting of the states general to the first of May in the ensuing year; and every step was taken to secure the favourable opinion of the public during the interval. New arrangements took place in the administration; and M. Neckar, whom the confidence of the people had long followed, was again introduced into the management of the finances; the torture, which by a former edict had been restricted in part, was now entirely abolished; every person accused was allowed the assistance of counsel, and permitted to avail himself of any point of law; and it was decreed, that in future sentence of death should not be passed on any person, unless the party accused should be pronounced guilty by a majority at least of three judges.

The time appointed for the convention of the states general was now approaching; and the means of assembling them formed a matter of difficult deliberation in the cabinet. The last meeting, in 1614, had been convened by application to the bailiwicks. But this mode was liable to several strong objections; the bailiwicks had been increased in number and jurisdiction, several provinces having since that period been united to France; and the numbers and quality of the members were no less an object of serious attention; it was not till the close of the year, therefore, that the proposal of M. Neckar was adopted, which fixed the number of deputies at 1000 and upwards, and ordained that the representatives of the third estate or commons should equal in number those of the nobility and clergy united.

The eyes of all Europe were now turned on the states general; but the moment of that assembly's meeting was far from auspicious: The minds of the French had long been agitated by various rumours; the unanimity that had been expected from the different orders of the states was extinguished by the jarring pretensions of each; and their mutual jealousies were attributed by the suspicions of the people to the intrigues of the court, who were supposed already to repent of the hasty assent which had been extorted. A dearth that pervaded the kingdom increased the general discontent; and the people, pressed by hunger, and inflamed by resentment, were ripe to revolt. The sovereign also, equally impatient of the obstacles he continually encountered, could not conceal his chagrin; while the influence of the queen in the cabinet was again established, and was attended by the immediate removal of M. Neckar. The dismission of that minister, so long the favourite of the public, was the signal of open insurrection; the Parisians assembled in myriads; the guards refused to oppose and stain their arms with the blood of their fellow citizens; the Count d'Artois and the most obnoxious of the nobility thought themselves happy in eluding by flight the fury of the insurgents; and in a moment a revolution was accomplished, the most remarkable perhaps of any recorded in history.

201 Insurrections and revolution.

But before we proceed in our narration, and detail the

the transactions which have marked the progress of this singular and terrible revolution, it may be worth while to take a short view of the internal situation of France previous to this period, and the more obvious political causes, the operation of which seems to have contributed to the production of this great event.

The moral history of man is always more important than the mere recital of any physical occurrences that may take place in his lot. It is not the fall of a mighty monarch and the dispersion of his family; it is not the convulsions of empires, and the oceans of human blood which have been shed, that render the French revolution peculiarly interesting. Such events, however deplorable, are far from being without example in the history of mankind. In the populous regions of the east, where superstition and slavery have always prevailed, they are regarded as forming a part of the ordinary course of human affairs; because an intrepid and skilful usurper finds it easy to intimidate or ensnare millions of weak and credulous men. In Europe the case is very different; no adventurer can advance far without encountering thousands as artful and as daring as himself. Events are not the result either of blind hazard or of individual skill; conspiracies or plots produce little effect. Like other arts, the art of government has been brought to much perfection; and an established constitution can only be shaken by the strong convulsion produced by national passions and efforts. The wonderful spectacle which we are now to contemplate, is that of a mild and polished people becoming in an instant sanguinary and fierce; a well established government, celebrated for its dexterity and skill, overturned almost without a struggle; a whole nation apparently uniting to destroy every institution which antiquity had hallowed or education taught them to respect; a superstitious people treating the religion of their fathers with contempt; a long-enslaved people, whose very chains had become dear to them, occupied in their public councils in the discussion of refined and even visionary schemes of freedom: in short, 25,000,000 of persons suddenly treading under foot every sentiment and every prejudice that they themselves had once regarded as sacred and venerable.

202
France formerly under a barbarous aristocracy.

Like the other nations of Europe, France was anciently governed by a barbarous aristocracy, whose different members were feebly united by the authority of a succession of kings destitute of power or influence. The nobles, within their own territories, enjoyed privileges entirely royal: they made peace and war; they coined money; they were judges in the last resort; their vassals were their slaves, whom they bought and sold along with the lands; the inhabitants of cities, although freemen, were depressed and poor, depending for protection upon some tyrannical baron in their neighbourhood. At length, however, by the progress of the arts, the cities rose into considerable importance, and their inhabitants, along with such freemen of low rank as resided in the country, were considered as entitled to a representation in the states-general of the kingdom, under the appellation of *tiers etat*, or *third estate;* the clergy and the nobles forming the two first estates. But the sovereign having speedily become despotic, the meetings of the states-general were laid aside. This absolute authority, on the part of the crown, was not acquired, as it was in England by the house of Tudor, by abolishing the pernicious privileges of the nobles and elevating the commons; but by skilful encroachments, by daring exertions of prerogative, and the use of a powerful military force. In France, therefore, the monarch was absolute, yet the nobles retained all their feudal privileges, and the ecclesiastical hierarchy did the same. The following was, in a few words, the state of that country during these two last centuries.

203
Was never reduced into one homogeneous mass.

The kingdom of France, previous to the revolution, was never reduced to one homogeneous mass. It consisted of a variety of separate provinces acquired by different means; some by marriage, some by legacy, and others by conquest. Each province retained its ancient laws and privileges, whether political or civil, as expressed in their capitularies or conditions by which they were originally acquired. In one part of his dominions the French monarch was a count, in another he was a duke, and in others he was a king; the only bond which united his vast empire being the strong military force by which it was overawed. Each province had its barriers; and the intercourse betwixt one province and another was often more restrained by local usages than the intercourse of either with a foreign country. Some of the provinces, such as Bretagne and Dauphiné, even retained the right of assembling periodically their provincial states; but these formed no barrier against the power of the court.

204
The clergy formed the first estate in the kingdom.

The clergy formed the first estate of the kingdom in point of precedence. They amounted to 130,000. The higher orders of them enjoyed immense revenues; but the *curés* or great body of acting clergy seldom possessed more than about 28l. sterling a-year, and their *vicaires* about half that sum. A few of their dignified clergy were men of great piety, who resided constantly in their dioceses, and attended to the duties of their office; but by far the greater number of them passed their lives at Paris and Versailles, immersed in all the intrigues and dissipation of a gay and corrupted court and capital. They were almost exclusively selected from among the younger branches of the families of the most powerful nobility, and accounted it a kind of dishonour to the order of bishops for any persons of low rank to be admitted into it. The lower clergy, on the contrary, were persons of mean birth, and had little chance of preferment. At the same time, we find several respectable exceptions to this last rule. The clergy, as a body, independent of the tithes, possessed a revenue arising from their property in land, amounting to four or five millions sterling annually; at the same time they were exempt from taxation. The crown had of late years attempted to break through this privilege. To avoid the danger, the clergy presented to the court a free gift of a sum of money somewhat short of a million sterling every five years.

205
The nobility the second.

The nobility was nominally the second order of the state, but it was in reality the first. The nobles amounted to no less than 200,000 in number. The title and rank descended to all the children of the family, but the property to the eldest alone: hence vast multitudes of them were dependent on the bounty of the court. They regarded the useful and commercial arts as dishonourable, and even the liberal professions of the law and physic as in a great measure beneath their dignity, dis-

daining

daining to intermarry with the families of their professors. The feudal system in its purity was extremely favourable to the production of respectable qualities in the minds of those who belonged to the order of the nobles; but the introduction of commerce has rendered its decline equally unfavourable to that class of men. Instead of the ancient patriarchal attachment between the feudal chieftain and his vassals, the nobility had become greedy landlords in the provinces, that they might appear in splendour at court and in the capital. There, lost in intrigue, sensuality, and vanity, their characters became frivolous and contemptible. Such of the French noblesse, however, as remained in the provinces, regarded with indignation this degradation of their order, and still retained a proud sense of honour and of courage, which has always rendered them respectable. The order of the nobles was exempted from the payment of taxes, although the property of some of them was immense. The estates of the prince of Condé, for example, were worth 200,000l. a-year, and those of the duke of Orleans nearly twice as much. The crown had indeed imposed some trifling taxes upon the noblesse, which, however, they in a great measure contrived to elude.

206 The parliament the third.

Next to the nobles, and as a privileged order possessing a secondary kind of nobility of their own, we may mention the parliaments. These were large bodies of men, in different provinces, appointed as courts of law for the administration of justice. In consequence of the corruption of the officers of state, the members purchased their places, which they held for life; but the son was usually preferred when he offered to purchase his father's place. In consequence of this last circumstance, the practising lawyers had little chance of ever becoming judges. Courts thus constituted, consisted of a motley mixture of old and young, learned and ignorant, men. Justice was ill administered. The judges allowed their votes in depending causes to be openly solicited by the parties or their friends. No wise man ever entered into a litigation against a member of one of these parliaments; no lawyer would undertake to plead his cause; it never came to a successful issue, and usually never came to any issue at all. After the states-general had fallen into disuse, the parliaments acquired a certain degree of political consequence, and formed the only check upon the absolute power of the crown. The laws, or royal edicts, before being put in force, were always sent to be registered in the books of the parliaments. Taking advantage of this, in favourable times and circumstances, they often delayed or refused to register the royal edicts, and presented remonstrances against them. This was done under a kind of legal fiction: for they pretended that the obnoxious edict being injurious to the public happiness, could not be the will of the king, but must either be a forgery or an imposition by the ministers. These objections were got the better of, either by a positive order from the king, or by his coming in person and ordering the edict to be registered. The parliaments, however, often carried their opposition very far, even to the ruin of themselves and their families as individuals. This rendered them extremely popular with the nation, and enabled them to embarrass a weak administration. After all, however, the opposition of the parliaments was so feeble, that it was never thought worth while to abolish them entirely till towards the end of the reign of Louis XV.; but they were restored as a popular measure, at the beginning of the reign of Louis XVI.

207 The commons the lowest order. Oppressive burdens of them.

The *tiers etat*, or commons, formed the lowest order of the state in France, and they were depressed and miserable in the extreme. To form a conception of their situation, it is necessary to observe that they bore the whole pecuniary burdens of the state: They alone were liable to taxation. An expensive and ambitious court; an army of 200,000 men in time of peace, and of twice that number in war; a considerable marine establishment, public roads and works, were all supported exclusively by the lowest of the people. To add to the evil, the revenues were ill collected. They were let out to farmers-general at a certain sum, over and above which they not only acquired immense fortunes to themselves, but were enabled to advance enormous presents to those favourites or mistresses of the king or the minister, by means of whom they procured their places. To raise all this money from the people, they were guilty of the cruellest oppression, having it in their power to obtain whatever revenue laws they pleased, and executing them in the severest manner. For this last purpose they kept in pay an army of clerks, subalterns, scouts, and spies, amounting to 80,000 men. These men were indeed detested by the king, whom they deceived and kept in poverty; by the people, whom they oppressed; and by the ancient nobility, as purse-proud upstarts. But the court of France could never contrive to manage without them. The peasants could be called out by the intendants of the provinces, in what they called *corvées*, to work upon the high roads for a certain number of days in the year, which was a source of severe oppression, as the intendant had the choice of the time and place of their employment, and was not bound to accept of any commutation in money. They were moreover subject to the nobles in a thousand ways. The nobles retained all their ancient manorial or patrimonial jurisdictions. The common people being anciently slaves, had obtained their freedom upon different conditions. In many places they and their posterity remained bound to pay a perpetual tribute to their feudal lords. Such tributes formed a considerable part of the revenue of many of the provincial nobles. No man could be an officer of the army, by a late regulation, who did not produce proofs of nobility for four generations. The parliaments, although originally of the *tiers etat*, attempted also to introduce a rule that none but the noblesse should be admitted into their order. In such a situation, it will not be accounted surprising that the common people of France were extremely superstitious and ignorant. They were, however, passionately devoted to their monarch, and whatever concerned him. In 1754, when Louis XV. was taken ill at Metz, the whole nation was truly in a kind of despair. The courier and his horse that brought the news of his recovery to Paris were both almost suffocated by the embraces of the people.

208 Despotic power of the king.

We have said that the French monarch was despotic. His power was supported by his army, and by a watchful police, having in pay an infinite host of spies and other servants. In France no man was safe. The secrets of private families were searched into. Nothing

was

was unknown to the jealous inquisition of the police. Men were seized by *lettres de cachet* when they least expected it, and their families had no means of discovering their fate. The sentence of a court of law against a nobleman was usually reversed by the minister. No book was published without the license of a censor-general appointed by the court, and the minister was accountable to none but the king. No account was given of the expenditure of the public money. Enormous gratifications and pensions were given as the reward of the most infamous services. The supreme power of the state was usually lodged with a favourite mistress, and she was sometimes a woman taken from public prostitution. This was not indeed the case under Louis XVI. but it was nevertheless one of the misfortunes of his life that he was far from being absolute in his own family. Still, however, with all its faults, the French court was the most splendid and polished in Europe. It was more the resort of men of talents and literature of every kind, and there they met with more ample protection, than anywhere else. The court was often jealous of their productions, but they met with the most distinguished attention from men of fortune and rank; insomuch that for a century past the French have given the law to Europe in all questions of taste, of literature, and of every polite accomplishment. The gay elegance that prevailed at court diffused itself through the nation; and amidst much internal misery, gave it to a foreigner the appearance of happiness, or at least of levity and vanity.

209 Splendour of the court &c.

210 Causes of the revolution.

Such as it was, this government had stood for ages, and might have continued, had not a concurrence of causes contributed to its overthrow. The inferior orders of clergy, excluded from all chance of preferment, regarded their superiors with jealousy and envy, and were ready to join the laity of their own rank in any popular commotion. The inferior provincial noblesse beheld with contempt and indignation the vices and the power of the courtiers, and the higher nobility wished to diminish the power of the crown. The practising lawyers, almost entirely excluded from the chance of becoming judges, wished eagerly for a change of affairs, not doubting that their talents and professional skill would render them necessary amidst any alterations that could occur. Accordingly, they were the first instruments in producing the revolution, and have been its most active supporters. The moneyed interest wished eagerly for the downfal of the ancient nobility. As for the great mass of the common people, they were too ignorant, too superstitiously attached to old establishments, and too much depressed, to have any conception of the nature of political liberty, or any hope of obtaining it. We have already stated the leading circumstances which led to the French revolution (see N° 184, &c.); but there were other circumstances which contributed in an equal degree both to its commencement and its progress.

For 40 years the principles of liberty had been disseminated with eagerness in France by some men of great talents, as Rousseau, Helvetius, and Raynal, to whom the celebrated Montesquieu had led the way. Besides these, there was in France a vast multitude of what were called *men of letters*, or persons who gave this account of the manner in which they spent their time. All these were deeply engaged on the side of some kind of political reform. The men of letters in Paris alone are said to have amounted to 20,000. One of the last acts of the administration of the archbishop of Thoulouse was, on the 5th July 1788, to publish a resolution of the king in council, inviting all his subjects to give him their advice with regard to the state of affairs. This was considered as a concession of an unlimited liberty of the press; and it is scarcely possible to form an idea of the infinite variety of political publications which from that period diffused among the people a dissatisfaction with the order of things in which they had hitherto lived.

The established religion of France had for some time past been gradually undermined. It had been solemnly assaulted by philosophers in various elaborate performances; and men of wit, among whom Voltaire took the lead, had attacked it with the dangerous weapon of ridicule. The Roman Catholic religion is much exposed in this respect, in consequence of the multitude of false miracles and legendary tales with which its history abounds. Without discriminating betwixt the respectable principles on which it rests, and the superstitious follies by which they had been defaced, the French nation learned to laugh at the whole, and rejected instead of reforming the religion of their fathers. Thus the first order in the state had already begun to be regarded as useless, and the minds of men were prepared for important changes.

The immense population of the city of Paris, amounting to upwards of 800,000 souls, rendered it an important engine in the hands of the conductors of the revolution. An overgrown capital has always proved dangerous to a government that is or attempts to be despotic, as appears from the history of ancient Babylon and Rome, as well as of modern Constantinople, of London under Charles I. and Paris under several of its kings.

We cannot here avoid mentioning a physical event, which assisted not a little in producing many of the convulsions attending the revolution, a general scarcity of grain, which occurred about that period. On Sunday the 13th of July 1788, about nine in the morning, without any eclipse, a dreadful darkness suddenly overspread several parts of France. It was the prelude of such a tempest as is unexampled in the temperate climates of Europe. Wind, rain, hail, and thunder, seemed to contend in impetuosity; but the hail was the great instrument of ruin. Instead of the rich prospects of an early autumn, the face of nature in the space of an hour presented the dreary aspect of universal winter. The soil was converted into a morass, the standing corn beaten into the quagmire, the vines broken to pieces, the fruit trees demolished, and unmelted hail lying in heaps like rocks of solid ice. Even the robust forest trees were unable to withstand the fury of the tempest. The hail was composed of enormous, solid, and angular pieces of ice, some of them weighing from eight to ten ounces. The country people, beaten down in the fields on their way to church, amidst this concussion of the elements, concluded that the last day was arrived; and scarcely attempting to extricate themselves, France. themselves, lay despairing and half suffocated amidst the water and the mud, expecting the immediate dissolution of all things. The storm was irregular in its devastations. While several rich districts were laid entirely waste, some intermediate portions of country were comparatively little injured. One of 60 square leagues had not a single ear of corn or fruit of any kind left. Of the 66 parishes in the district of Pontoise, 43 were entirely desolated, and of the remaining 23 some lost two-thirds and others half their harvest. The Isle of France, being the district in which Paris is situated, and the Orleannois, appear to have suffered chiefly. The damage there, upon a moderate estimate, amounted to 80,000,000 of livres, or between three and four millions sterling. Such a calamity must at any period have been severely felt; but occurring on the eve of a great political revolution, and amidst a general scarcity throughout Europe, it was peculiarly unfortunate, and gave more embarrassment to the government than perhaps any other event whatever. Numbers of families found it necessary to contract their mode of living for a time, and to dismiss their servants, who were thus left destitute of bread. Added to the public discontent and political dissensions, it produced such an effect upon the people in general, that the nation seemed to have changed its character; and instead of that levity by which it had ever been distinguished, a settled gloom now seemed fixed on every countenance.

211 Attempt to reduce the power of the crown in spring 1789.

The spring of the year 1789 was a period of much political anxiety in France. The superior orders wished to reduce the power of the crown, but were jealous of their own privileges, and determined to retain them; while the popular philosophers and others were endeavouring to render them odious, and to rouse the people to a love of freedom. Still, however, the great body of the common people remained careless spectators of the struggle, and unconscious of the approaching commotion. Such was their indifference, that few of them took the trouble even to attend and vote at the elections of the deputies to the states-general. In many places, where a thousand voters were expected, not fifty came forward; but such of them as did appear showed that a seed was sown which might one day rise into important fruits. In the instructions which they gave to their deputies, the British constitution was in general the model of what they wished their government to be. They demanded equal taxation, the abolition of *lettres de cachet* or arbitrary imprisonment, the responsibility of ministers, and the extinction of the feudal privileges of the nobles; but they wished that the whole three orders of the state should sit and vote in one house, well knowing that their nobility were not prepared to act the moderate part of a British house of lords. The nobles, on the contrary, although willing to renounce some of their pecuniary privileges, and to sacrifice the power of the crown, were most decisively resolved neither to surrender their feudal prerogatives nor the right of sitting in three separate assemblies; by means of which each of the orders could easily resist the encroachments of the other two. M. Neckar has been improperly censured for not deciding this last important question previous to the meeting of the states-general; but it must be observed, that the very purpose of calling that assembly was to overturn the unjust privileges of the higher orders through its medium, and without any direct interposition on the part of the ministers. Had the king positively decided in favour of three chambers, the nobles and the clergy would have retained all those ancient abuses established in their own favour, of which it was his wish to deprive them, and the crown and its prerogatives would have been the only objects of sacrifice. It was therefore thought safer to leave the *tiers etat* to fight its own battle; nor was it yet imagined that the commons of France, depressed and poor, and dispersed by situation over a multitude of provinces, could ever unite in enterprises dangerous to the sovereign.

212 States summoned to meet at Versailles.

The states had been summoned to meet at Versailles on the 27th of April, and most of the deputies arrived at that time; but the elections for the city of Paris not being concluded, the king deferred the commencement of their sessions till the 4th of May. During this period, the members, left in idleness, began to find out and form acquaintance with each other. Among others, a few members from Brittany (Bretagne) formed themselves into a club, into which they gradually admitted many other deputies that were found to be zealous for the popular cause, and also many persons who were not deputies. This society, thus originally established at Versailles, was called the *Comité Breton*; and was one day destined, under the appellation of the *Jacobin Club*, to give laws to France, and to diffuse terror and alarm throughout Europe. On the other side, the aristocratic party established conferences at the house of Madame Polignac, for the purpose, it is said, of uniting the nobles and the clergy.

213 A popular riot in the suburb of St Antoin.

An event occurred at this time which all parties ascribed to some malicious motive. In the populous suburb of St Antoine, a M. Reveillon carried on a great paper manufactory. A false report was spread that he intended to lower the wages of his workmen, and that he had declared bread was too good for them, and that they might subsist very well on potato-flour. A commotion was raised, he was burnt in effigy, and his house was thereafter burnt and pillaged by the mob, who were not dispersed till the military had been called in, and much carnage ensued. The popular party asserted that the commotion had been artfully excited by the party of the queen and the Count D'Artois, to afford a pretence for bringing great bodies of the military to the neighbourhood to overawe the states-general, or induce the king more decisively to resolve on assembling that body at Versailles, in preference to Paris, where they and the popular minister M. Neckar wished it to be held.

214 The States General commence business at Versailles.

On the 4th of May the states general assembled at Versailles. They commenced business by going in a solemn procession, preceded by the clergy, and followed by the king, according to ancient custom, to church, to perform an act of devotion. The nobles were arrayed in a splendid robe, and they and the higher clergy glittered in gold and jewels. The commons appeared in black, the dress belonging to the law. The assembly was thereafter opened by a short

short speech from the throne, in which the king congratulated himself on thus meeting his people assembled; alluded to the national debt, and the taxes, which were severely felt because unequally levied; he took notice of the general discontent and spirit of innovation which prevailed, but declared his confidence in the wisdom of the assembly for remedying every evil. "May an happy union (added he) reign in this assembly; and may this epocha become ever memorable for the happiness and prosperity of the country. It is the wish of my heart; it is the most ardent desire of my prayers; it is, in short, the price which I expect from the sincerity of my intentions and my love for my people."

M. Barretin, the keeper of the seals, next addressed the assembly in a congratulatory and uninteresting speech. He was followed by the popular minister M. Neckar, who spoke for three hours. Though much applauded on account of the clear financial details which his speech contained, he encountered a certain degree of censure from all parties, on account of the cautious ambiguity which he observed with regard to the future proceedings of the states-general.

215 Their debates and inactivity.

Next day the three orders assembled separately. The deputies of the *tiers etat* amounted to 600 in number, and those of the nobles and clergy to 300 each. During their first sittings much time was spent in unimportant debates about trifling points of form; but the first important question, that necessarily became the subject of their discussion, was the *verification of their powers*, or production of the commissions of the members, and investigation of their authenticity. The commons (*tiers etat*) laid hold of this as a pretext for opening the grand controversy, whether the states-general should sit in one or in three separate chambers? They sent a deputation inviting the nobles and the clergy to meet along with them in the common hall for the purpose of *verifying their powers* in one common assembly. In the chamber of the clergy 114 members voted for the performance of this ceremony in the general assembly; and 133 against it. But in the more haughty order of the nobles, the resolution for the verification in their own assembly was carried by a majority of 188 against 37. The commons paid no regard to this. They were conducted by bold and skilful leaders, who discerned the importance of the point in contest, and resolved not to abandon it. Aware of the exigencies of the state, they knew that the crown was nearly verging upon bankruptcy; and that such were the deficiencies of the revenue, that only a short delay was necessary to accomplish the absolute dissolution of the government. They suffered five weeks to pass away therefore in total inactivity. During this period proposals were made on the part of the ministry for a pacification between the three orders, and conferences were opened by commissioners from each. But no art could seduce the commons from their original purpose, or prevail with them to enter upon the business of the state.

216 Popularity of the Tiers Etat or commons.

The nation had expected much from the assembling of the states-general, and learnt the news of their inaction with no small degree of concern. The *tiers etat* was naturally popular, and the public censure could not readily devolve upon that favourite order. Moreover, from the first period of their assembling, the commons made every effort to augment their own natural popularity. They admitted all persons promiscuously into the galleries, and even into the body of their hall. No restraint was attempted to be laid upon the most vehement marks of popular applause or censure. Lists of the voters names were publicly taken and sent to Paris upon every remarkable occasion; and the members suddenly found themselves become, according to their political sentiments, the objects of general execration or applause. The new and bold notions of liberty that were daily advanced by the leaders of the *tiers etat* were received with acclamation by their hearers. The capital became interested in the issue of every debate; and the political fervor was eagerly imbibed by the nation with that vivacity which is so peculiar to the French. The commons accused the nobles of obstinately impeding the business of the state, by refusing to verify their powers in one common assembly. The accusation was swallowed by the multitude, who saw not, or were unwilling to see, that the attack was made by their own favourite order. In the mean time the nobles became rapidly more and more unpopular. Their persons were insulted, new publications daily came forth, and were greedily bought up, which reviled their whole order, and represented them as an useless or pernicious body of men, whose existence ought not to be tolerated in a free state. Whoever adhered to them was branded with the odious appellation of *Aristocrat*. The clergy, from the influence of the parish *curés* or parsons, seemed ready to desert their cause. They were even opposed by a minority of their own body, which derived lustre from having at its head the duke of Orleans the first prince of the blood. Still, however, the majority of the nobles remained firm; well aware, that if they once consented to sit in the same assembly, and to vote promiscuously, with the ambitious and more numerous body of the commons, their whole order, and all its splendid privileges must speedily be overthrown.

217 Taking advantage of this popularity, they seize the legislative authority;

The leaders of the commons saw the change that was taking place in the minds of men; and they at length regarded the period as arrived when they ought to emerge from their inactivity, and execute the daring project of seizing the legislative authority in their country. They declared that the representatives of the nobles and the clergy were only the deputies of particular incorporations whom they would allow to sit and vote along with themselves; but who had no title in a collective capacity to act as the legislators of France. For conducting business with more facility, they appointed 20 committees. In consequence of a proposal by the Abbe Sieyes, a final message was sent to the privileged orders, requiring their attendance as individuals, and intimating that the commons, as the deputies of 96 out of every hundred of their countrymen, were about to assume the exclusive power of legislation. None of the nobles obeyed this summons; but three curés, Messrs Cesve, Ballard, and Jallot, presented their commissions, and were received with loud acclamations. They were next day followed by five more, among whom were Messrs Gregoire, Dillon, and Bodineau. After some debate concerning the appellation which they ought to assume, the commons, with such

France. 1789. such of the clergy as had joined them, solemnly voted themselves the sovereign legislators of their country, under the name of the *National Assembly*. The result of the vote was no sooner declared, than the hall resounded with shouts from the immense concourse of spectators, of "Vive le roi et vive l'assemblée nationale," *Long live the king and the national assembly*. M. Bailly was chosen president for four days only, Messrs Camus and Pison de Galand secretaries, and the assembly proceeded to business.

218 And assert their own sovereignty.

Its first acts were decisively expressive of its own sovereignty. All taxes imposed without the consent of the representatives of the people were declared to be null and void; but a temporary sanction was given to the present taxes, although illegal, till the dissolution of the assembly, and no longer. It was added, that "as soon as, in concert with his majesty, the assembly should be able to fix the principles of national regeneration, it would take into consideration the *national debt*, placing, from the present moment, the creditors of the state under the safeguard and honour of the French nation."

219 Majority of the clergy unite with them.

The popular cause now gained ground so fast, that on the 19th of June a majority of the clergy voted for the verification of their powers in common with the national assembly, and they resolved to unite with them on the following day.

220 Fears of the nobles.

Affairs were now come to a crisis, and the nobles perceived that they must instantly make a decisive stand, or yield up their cause as finally lost. Such was their alarm, that M. d'Espremenil proposed, at one of the sittings of their order, to address the king, intreating him to dissolve the states-general. Hitherto that prince had gone along with M. Neckar in favouring the popular cause in opposition to the aristocracy. But every art was now used to alarm his mind upon the subject of the late assumptions of power on the part of the commons, and these arts were at length successful. Repeated councils were held; M. Neckar was absent attending a dying sister, and the king was prevailed upon to act agreeably to the advice of the leaders of the nobles. But the first measure which they adopted was so ill conducted as to afford little prospect of final success to their cause. On the 20th of June, when the president and members were about to enter as usual into their own hall, they found it unexpectedly surrounded by a detachment of the guards, who refused them admission, while the heralds at the same time proclaimed a royal session. Alarmed by this unforeseen event, the meaning of which they knew not, but apprehending that an immediate dissolution of the assembly was designed, they instantly retired to a neighbouring tennis court, where, in the vehemence of their enthusiasm, they took a solemn oath "never to separate till the constitution of their country should be completed."

221 Royal session proclaimed.

On the 22d a new proclamation intimated that the royal session was deferred till the following day. It was now found that the assembly had been excluded from their hall merely because the workmen were occupied in preparing it for the intended solemnity. This information was ill calculated to excite favourable expectations of the measures about to be adopted at a royal session, ushered in by such circumstances of marked disrespect for the representatives of the people. The assembly, after wandering about in search of a place of meeting, at length entered the church of St Louis, and were immediately joined by the majority of the clergy, with their president, the archbishop of Vienne, at their head. Two nobles of Dauphiné, the marquis de Blaçon and the count d'Agoult, presented their commissions at the same time. Encouraged by these events, and by the applauses of surrounding multitudes, the assembly now expected with firmness the measures about to be adopted.

France. 1789. 222 The Assembly meets in the church of St Louis.

223 Discourse of the king.

The royal session was held in the most splendid form, but altogether in the style of the ancient despotism. Soldiers surrounded the hall. The two superior orders were seated, while the representatives of the people, left standing a full hour in the rain, were in no humour, when at last admitted, to receive with much complacency the commands of their sovereign. The king read a discourse, in which he declared null and void the resolutions of the 17th, but at the same time presented the plan of a constitution for France. It contained many good and patriotic principles, but preserved the distinction of orders, and the exercise of *letters de cachet*; it said nothing about any active share in the legislative power to be possessed by the states-general, and was silent both about the responsibility of ministers and the liberty of the press. The king concluded by commanding the deputies immediately to retire, and to assemble again on the following day. He then withdrew, and was followed by all the nobles and a part of the clergy. The commons remained in gloomy silence on their seats. It was interrupted by the grand master of the ceremonies, who reminded the president of the intentions of the king. Instantly the vehement count de Mirabeau, starting from his seat, exclaimed with indignation, "The commons of France have determined to debate. We have heard the intentions that have been suggested to the king; and you, who cannot be his agent with the states-general, you who have here neither seat nor voice, nor a right to speak, are not the person to remind us of his speech. Go tell your master that we are here by the power of the people, and that nothing shall expel us but the bayonet." The applause of the assembly seconded the enthusiasm of the orator, and the master of the ceremonies withdrew in silence.

224 Ill received by the commons.

225 Debates after the king's departure.

M. Camus then rose; and in a violent speech indignantly stigmatized the royal session by the obnoxious appellation of a *bed of justice*; he concluded by moving that the assembly should declare their unqualified adherence to their former decrees. This motion was followed by another, pronouncing the persons of the deputies inviolable. Both were supported by Messrs Petion, Barnave, Glaizen, the Abbes Gregoire, Sieyes, and many others, and were unanimously decreed. The assembly, therefore, continued their sittings in the usual form. On the following day the majority of the clergy attended as members; and on the 25th the duke of Orleans, along with 49 of the deputies belonging to the order of nobles, joined them also. The remaining nobles, as well as the small minority of the clergy, now found themselves awkwardly situated. Whether on this account, or because their leaders had by this time formed a plan for carrying their point not by peaceable means but by the aid of a military force, the king, on the 27th, invited by a pressing letter both orders to to join the commons. This request was immediately complied with, although many of the nobility disapproved of the measure.

226 Alarming situation of France at this period.

The situation of France was now become truly alarming. When the king retired from the assembly after the royal session, he was followed by more than 6000 citizens, from whom loud clamours and every mark of disapprobation broke forth. All Versailles was speedily in an uproar. M. Neckar had repeatedly solicited his dismission, and the report of this had increased the popular clamour. The court was in consternation. The king probably discovered, with no great satisfaction, that his minister was more popular than himself. At six o'clock in the evening the queen sent for M. Neckar. When he returned from the palace, he assured the crowd that waited for him that he would not abandon them; upon which they retired satisfied. At the same time the news of the royal session had thrown the city of Paris into violent agitation. The peace of that capital was at this time deranged by a variety of causes. A dreadful famine raged through the land, which in a great city is usually most severely felt. This prepared the minds of men for receiving unfavourable impressions of their political state. Every effort was moreover made to disorganize the government, and pro-

227 Numerous seditious publications.

duce a dislike to the ancient order of things. The press poured forth innumerable publications, filled with new and seducing, though generally impracticable, theories of liberty. These were distributed *gratis* among the bulk of the people of Paris, and dispersed in the same manner through the provinces. Philip duke of Orleans) presumptive heir to the crown, failing the children and brothers of the king) is with good reason believed to have supplied this expence out of his more than royal revenues. In the gardens of the Palais Royal at Paris, which belonged to him, an immense multitude was daily assembled, listening from morning to night to orators who descanted upon the most violent subjects of popular politics. Many of these orators were suspected to be in his pay. It was even believed that his money found its way into the pockets of some of the most distinguished leaders in the national assembly.

228 Seduction of the military.

But the government was, if possible, still more dangerously assaulted by the methods now generally used to seduce the military. Every officer of the French army belonged to the order of the nobles; and from that quarter, therefore, it might have been imagined that there was little danger. But this very circumstance became the means of disorganizing that great engine of despotism. As the soldiers could not avoid imbibing some of the new opinions, their own officers became the first objects of their jealousy; especially in consequence of that impolitic edict of Louis XVI. which required every officer to produce proofs of four degrees of nobility; and thus insulted, by avowedly excluding the private men from promotion. Perhaps with a view to what might happen, the instructions to the deputies of the *tiers etat* had recommended an increase of the pay of the soldiers. And now at Paris every art was used to gain them to the popular cause. They were conducted to the Palais Royal, and were there caressed and flattered by the populace, while they listened to the popular harangues. These arts were successful. On the 23d of June they first refused to fire on the mob in a riot. Some of them were on the 30th reported to be in confinement for this offence; a crowd instantly collected, and rescued them, the dragoons that were brought to suppress the tumult grounding their arms. A deputation of the citizens solicited of the assembly the pardon of the prisoners. The assembly applied to the king, who pardoned them accordingly.

229 The military called out.

All these events, together with the tumultuous state of the capital, which was daily increasing, made it necessary for the king to call out the military force to restore, if possible, the public peace. That his intentions were pure, the then state of affairs will permit no man but a democrat to doubt; but the aristocracy, with the Count d'Artois at their head, were bringing forward other measures, which ultimately contributed to the ruin of themselves, the king, and the kingdom. Crowds of soldiers were collected from all parts of the kingdom around Paris and Versailles. It was observed that these consisted chiefly of foreign mercenaries. Camps were traced out. Marshal Broglio, a tried veteran, was sent for and placed at the head of the army. The king was supposed to have entirely yielded to new counsels, and every thing bore the appearance of a desperate effort to restore the energy of the ancient government. This is the most important period of the French revolution; yet the specific designs of the leading actors have never been clearly understood. It was rumoured at the time, that Paris was to be subdued by a siege and bombardment; that the assembly was to be dissolved, and its leaders put to death. These are incredible exaggerations; but the crisis of French liberty was universally regarded as at hand, and also the existence of the national assembly as an independent body; or at least upon any other footing than that proposed by the king on the 23d of June.

230 The assembly address the king to remove them, which is refused.

An able and eloquent address to the king against the assemblage of foreign troops in their neighbourhood was brought forward by Mirabeau, and voted by the assembly. The king properly replied, that the state of the capital was the cause of assembling the troops, and offered to transfer the states-general to Noyons or Soissons. "We will neither remove (exclaimed Mirabeau) to Noyons or to Soissons; we will not place ourselves between two hostile armies, that which is besieging Paris, and that which may fall upon us through Flanders or Alsace; we have not asked permission to run away from the troops; we have desired that the troops should be removed from the capital."

Thirty-five thousand men were now stationed in the neighbourhood of Paris and Versailles. The posts were occupied which commanded the city, and camps were marked out for a greater force. The Count d'Artois and his party regarded their plans as ripe for execution; and M. Neckar received a letter from the king, requiring him to quit the kingdom in 24 hours. That popular minister took the route of Brussels on the following day, when his departure was made public. In his dismission the popular, or, as it was now called, the *democratic* party, thought they saw the resolution adopted to accomplish their ruin. The assembly again addressed the throne; they requested anew the removal of the troops, offering to be responsible for the public peace, and to proceed in a body to Paris to encoun-

231 They again address the king;

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ter personally every danger that might occur. But they were coolly told, that the king was the best judge of the mode of employing the troops, and that the presence of the assembly was necessary at Versailles.

232 *and are again refused.*

From a sovereign who doubtless recollected the proceedings of the long parliament of England, a different reply could not in reason be expected.

233 *Decree of the assembly in consequence.*

On receiving it, however, it was instantly decreed, on the motion of the marquis de la Fayette, that the late ministry had *carried with them* the confidence of the assembly; that the troops *ought* to be *removed*; that the ministry are and shall be responsible to the people for their conduct; that the assembly persisted in all its former decrees; and that as it had taken the public debt under the protection of the nation, no power in France was entitled to pronounce the infamous word *bankruptcy*.

234 *Consternation in Paris on Neckar's retreat.*

The city of Paris was thrown into deep consternation by the news of M. Neckar's retreat. His bust and that of the duke d'Orleans were dressed in mourning, and carried through the streets. The royal Allemand, a German regiment, broke in pieces the busts, and dispersed the populace.

235 *Cruelty of the Prince De Lambesq.*

The prince de Lambesq, grand ecuyer of France, was ordered to advance with his regiment of cavalry, and take post at the Thuilleries. Being a man of a violent temper, and enraged by the appearances of disapprobation which were visible around him, he furiously cut down with his sword a poor old man who was walking peaceably in the gardens. The consequences of this act of inhumanity were such as might have been expected; a shout of execration instantly arose; the cry *to arms* was heard; the military were assaulted on all sides; the French guards joined their countrymen, and compelled the Germans, overpowered by numbers, and unsupported by the rest of the army, to retire.

236 *Terror in the city universal.*

All order was now at an end, and as night approached an universal terror diffused itself through the city. Bands of robbers were collecting; and from them or from the foreign soldiery a general pillage was expected. The night passed away in consternation and tumult. It was found in the morning that the hospital of St Lazare was already plundered. The alarm bells were rung; the citizens assembled at the Hotel de Ville, and adopted a proposal that was there made, of enrolling themselves as a militia for general defence, under the appellation of the *national guard*. This day and the succeeding night were spent in tolerable quietness, without any attempt on the part of the army. On the morning of the memorable 14th of July, it was discovered that the troops encamped in the Champs Elisees had moved off, and an immediate assault was expected. The national guard now amounted to 150,000 men; but they were in general destitute of arms. They had assumed a green cockade; but on recollecting that this was the livery of the Count d'Artois, they adopted one of red, blue, and white. M. de la Salle was named commander in chief, officers were chosen, and detachments sent round in quest of arms. In the Hotel des Invalides upwards of 30,000 stand of arms were found, along with 20 pieces of cannon; a variety of weapons was also procured from the *garde meuble de la couronne*, and from the shops of armourers, cutlers, &c.

The celebrated fortress of the Bastile was an object of much jealousy to the Parisians. At 11 o'clock in the morning, M. de la Rosiere, at the head of a numerous deputation, waited upon M. de Launay the governor, who promised, along with the officers of his garrison, that they would not fire upon the city unless they should be attacked.

237 *The Bastile attacked;*

But a report was soon spread through Paris, that M. de Launay had, in a short time thereafter, admitted into the fortress a multitude of persons, and then treacherously massacred them. The cause of this piece of perfidy has never been explained. The fact itself has been denied; but it was attested at the time by the duke of Dorset, the British ambassador at the court of France. The effect of the report was, that a sudden resolution was adopted of assaulting the Bastile; an immense and furious multitude rushed into its outer, and soon forced their way into its inner courts, where they received and returned a severe fire for the space of an hour. The French guards, who were now embodied into the national guard, conducted the attack with skill and coolness; they dragged three waggons loaded with straw to the foot of the walls, and there set them on fire; the smoke of these broke the aim of the garrison, while it gave no disturbance to the more distant assailants. The besieging multitude pressed the attack with incredible obstinacy and vigour for the space of four hours; the garrison was in confusion; the officers served the cannon in person, and fired their muskets in the ranks; the governor, in despair, thrice attempted to blow up the fortress.

238 *and surrendered unconditionally.*

A capitulation, when at last sought, was refused to the garrison, and an unconditional surrender took place. The governor, and M. de Losme Salbrai his major, a gentleman of distinguished humanity and honour, became victims of popular fury in spite of every effort that could be made for their protection; but the French guards succeeded in procuring the safety of the garrison. Only seven prisoners were found in the Bastile. A guard was placed in it, and the keys were sent to the celebrated M. Brissot de Warville, who a few years before had inhabited one of its caverns.

The remaining part of this eventful day was spent at Paris in a mixture of triumph and alarm. In the pocket of the governor of the Bastile a letter was found, encouraging him to resistance by the promise of speedy succours, written by M. de Flesselles, the prevot des marchands, or chief city magistrate, who had pretended to be a most zealous patriot. This piece of treachery was punished by instant death; and his bloody head was carried through the city on a pole, along with that of M. de Launay. At the approach of night a body of troops advanced towards the city, at the Barriere d'Enfer. The new national guard hurried thither, preceded by a train of artillery, and the troops withdrew upon the first fire: barricadoes were everywhere formed, the alarm-bells were rung, and a general illumination continued during the whole of this night of confusion.

239 *A new ministry appointed.*

In the mean time, it was obvious that the new ministry were entering upon a difficult scene of action, where one false step might lead to ruin, and where their own plan of conduct ought to be maturely digested. Marshal Broglio was made minister of war, the baron de Breteuil president of finance, M. de la Galeziere comptroller-general, M. de la Porte intendant of the war department, and M. Foulon intendant of the navy;

ance. 789. 240 ir situa- diffi- , and r con- bad.

navy; but these were only meant to act as official men, under the Count d'Artois, and the other leaders of the aristocracy. To these leaders there did not even remain a choice of difficulties; no resource was left but that of overawing by military power the national assembly and the capital, and of risking the desperate measure of a national bankruptcy, which the court had not formerly dared to encounter, and to avoid which it had convoked the states-general. No trace remains, however, of any attempts to put this criminal, but last resource, in execution. The evening after the departure of M. Neckar was spent by the court of Versailles in feasting and joy, as if a victory had been gained. The courtiers of both sexes went round among the soldiery, striving to secure their fidelity by caresses, largesses, and every species of flattering attention. The ministry not only failed to support the Prince de Lambesq in the post which he had been sent to occupy, but they suffered the whole of the 13th to pass in indecision, while the capital was in a state of rebellion, while an army was formally mustering within its walls, and the names of the principal nobility were put up in lists of proscriptions. They received the news of the capture of the Bastile with confusion and dismay, which were increased, if possible, by information given by Marshal Broglio, that the troops refused to act against Paris or the national assembly. In this perplexity they adopted the miserable device of concealing from the king the state of public affairs; and that unfortunate prince was thus perhaps the only person out of millions around him who remained ignorant of the convulsions in which his country was involved.

At length, at midnight, the duke de Liancourt forced his way into the king's apartment, and told him of the revolt of his capital, of his army, and of the surrender of the fortress of the Bastile. The Count d'Artois, who was present, still attempted to retain the monarch under his fatal delusion; but the duke de Liancourt turning round, exclaimed, "As for you, Sir, your life can only be saved by instant flight; I have seen with horror your name in the bloody list of the proscribed." Accordingly the count, with the members of his short-lived administration and their adherents, fled to the frontiers. And thus an emigration commenced, the source of that terrible contest which has covered Europe with bloodshed and mourning. This ministry had, no doubt, many difficulties to contend against; but an accurate attention to their conduct excites a suspicion which, while it exculpates them from many intended crimes that have been laid to their charge, at the same time does little honour to their talents. It is this, that they had come into office without having formed any clear plan of conduct; that they were men acting without decision and at random, and consequently became the sport of those events which they wanted skill and vigour to direct or controul. By their introduction into office, and their misconduct while in it, the royal authority fell prostrate before the popular party in the national assembly. The nobles and the clergy still remained, but confounded in one assembly with the more numerous order of the *tiers etat;* and no longer rallying round a throne that was too feeble to afford protection, they soon yielded to that fierce and levelling spirit of democracy that now rose around them.

France 1789. 241 The king goes to the assembly.

But the person of the monarch was still beloved.—Early next morning the king went to the assembly, but with none of the usual solemnities. He "regretted the commotions of the capital, disavowed any knowledge of an intention against the persons of the deputies, and intimated that he had commanded the removal of the troops." A deep and expressive silence prevailed for a few moments; this was succeeded by vehement and universal shouts of applause. The king rose to depart, and instantly the whole assembly crowded around, and attended him to his palace. The queen appeared at a balcony with the dauphin in her arms; the music played the pathetic air of *Où peut on être mieux qu'au sein de sa famille.* The enthusiasm of loyalty communicated itself to the surrounding multitudes, and nothing was heard but acclamations of joy.

242 And next day visits the city of Paris in person;

On the following day, the king declared his resolution to visit the city of Paris in person. Accordingly that prince, who never wanted personal courage, however deficient he might be in political stedfastness, set out, attended by some members of the assembly and by the militia of Versailles. He was met by the celebrated M. de la Fayette, at the head of a body of the national guard, of which he had now been chosen commander in chief. M. Bailly, in whose person the ancient office of mayor of Paris had been revived, received the king at the gates, and delivered to him the keys. All this while no shout was heard from the crowd of innumerable spectators but that of *Vive la nation.* The king advanced to the Hotel de Ville, where the new cockade was presented to him, which he put on, and presented himself with it at the window. At the sight of this badge of patriotism an universal shout of *Vive le Roi* burst forth from every quarter; and he returned to Versailles amidst general triumph and applause.

243 in which much confusion still prevailed.

Much confusion still prevailed in the capital; but there was more appearance of regularity than could have been expected at the conclusion of such important events. This arose from a casual concurrence of circumstances. To conduct with ease the elections to the states general, Paris had been divided into 60 districts, each of which had a separate place of meeting. The people did not elect the members to the states-general; but they chose delegates, who under the name of electors, voted for the members. At the commencement of the disturbances, the electors, at the request of their fellow-citizens, assumed a temporary authority; of which however they were soon weary, and as soon as possible procured the public election of 120 persons as municipal officers for the government of the city. The citizens having got the habit of assembling in their districts, grew fond of it: they assembled frequently, made rules for their own government, and sent commissioners to communicate with other districts. The tumultuous nature of these meetings, and the vehemence of debate which prevailed in them, will best be conceived from the ludicrous contrivance of one of their presidents, who stationed a drummer at the back of his chair, and when the confusion and noise became altogether ungovernable, gave the signal for beating the drum, which speedily overpowered every other noise. These meetings, however, gradually ripened into clubs, in which much dexterity and intrigue were exerted.

The whole of the late ministry escaped excepting M. Foulon,

France. 1789.

Foulon. His character, it may well be imagined, was extremely unpopular; for he is said to have asserted, that he would "make the people of Paris eat hay."

244 Fate of M. Foulon, and Berthier.

He had retired to the country, but was seized by his own vassals, and brought to Paris with a bundle of hay tied on his back. In spite of every effort made by M. M. Bailly and Fayette to procure him a fair trial at least, he was carried to the *Place de Greve*, and hanged at a lamp-iron by the enraged multitude. His son-in-law, M. Berthier, attempting to defend himself against a similar fate, fell, covered with wounds. Their heads were carried round on poles; and thus the populace became habituated to the sight of blood and murder: they were even taught by popular songs to glory in such actions, and particularly by the well known song *Ca-ira*.

245 Consequences of M. Neckar's return.

In consequence of an invitation from the king, M. Neckar returned to France. He was received by the assembly with great applause, and in Paris with infinite solemnity and triumph. He here, however, committed a political error that made some noise. In deploring the late excesses and murders, and taking notice of the arrest of M. Bezenval, an officer of the Swiss guards, he requested of the electors at the Hotel de Ville, in a solemn harangue, that the past should be forgotten; that proscriptions should cease, and a general amnesty be proclaimed. In a moment of enthusiasm this was agreed to, and the electors decreed what unquestionably exceeded their powers. The districts of Paris were instantly in commotion; the electors alarmed, declared that they only meant that "henceforth the people would punish no man but according to law;" and at the same time, to prove that they themselves were free from ambition, they formally renounced all their own powers. The assembly took up the question. Lally Tolendal, Mounier, Clermont Tonnerre, Garat junior, and others, declared that no person ought to be arrested without a formal accusation; while Mirabeau, Robespierre, Barnave, and Gleizen, alleged, on the contrary, that the people were entitled to lay hold of any man who had publicly appeared at the head of their enemies. The debate ended, by admitting the explanation of the electors, and by a declaration that it was the duty of the assembly to see justice executed in all cases.

246 The commotions, &c. of the capital reach to the provinces.

The commotions and enthusiasm of the capital were speedily communicated to the provinces. In every quarter the people seized upon all the arms that could be found, and the military uniformly refused to act against them. Many acts of outrage were committed in Brittany, at Strasburg, in the Lyonnois, and elsewhere, in which the nobility were the sufferers. The mischiefs that occurred were usually magnified at a distance; but that very circumstance was an additional evil. For example: It was stated in the National Assembly that M. de Mesmay, lord of Quincey, invited a number of patriots, among whom were the officers of a neighbouring garrison, to a splendid entertainment at his house, to celebrate the happy union of the three orders: That in the midst of the feast the master of the house contrived to withdraw unnoticed, and to set fire to a train previously laid, which communicated with a quantity of gunpowder in the cellars, in consequence of which, the whole company, by a sudden explosion, were blown into the air. It was found on inquiry, that there was not one word of truth in the whole story. But before this inquiry could be made, all France had resounded with accounts of the pretended bloody tragedy; and the whole nobility of the kingdom suffered in a less or greater degree, from the prejudices excited by this unhappy report, the origin of which has never been well explained. It would be vain to state all the idle rumours to which at this time the blind credulity of the multitude gave currency. At one time, the aristocrats were cutting down the green corn; at another time they were burying flour in common sewers, or casting loaves into the Seine. One report was no sooner proved to be false than another arose, and the whole nation was agitated by suspicion and alarm. The National Assembly were engaged in framing their celebrated declaration of the rights of man, which was to form the basis of the new constitution, when the alarming accounts received from all quarters, of the state of anarchy into which the kingdom was falling, obliged them suddenly to turn their attention to objects of practical necessity. The privileged orders found themselves become the objects of universal jealousy and hatred; and that something must instantly be done to save their families and property, which were menaced on every side with persecution and pillage. Regarding the popular torrent as now become irresistible, to save something they resolved to sacrifice a part.

247 Viscount Noailles and Duke d'Aguillon propose that

On the afternoon sitting of the 4th of August, the Viscount de Noailles, seconded by the Duke d'Aguillon, opened one of the most important scenes in the French Revolution, or in the history of any country. These noblemen stated, that the true cause of the commotions which convulsed the kingdom existed in the misery of the people, who groaned under the double oppression of public contributions and of feudal services. "For three months (said M. de Noailles) the people have beheld us engaged in verbal disputes, while their own attention and their wishes are directed only to things. What is the consequence? They are armed to reclaim their rights, and they see no prospect of obtaining them but by force." He therefore proposed to do justice, as the shortest way of restoring tranquillity, and

248 the taxes should be in proportion to the wealth of the contributors.

for that purpose to decree, that henceforth every tax should be imposed in proportion to the wealth of the contributors, and that no order of the state should be exempted from the payment of public burdens; that feudal claims should be redeemed at a fair valuation; but that such claims as consisted of personal services on the part of the vassal should be abolished without compensation, as contrary to the imprescriptible rights of man. The extensive possessions of the noblemen who made these proposals added much lustre to the disinterested sacrifice which they afforded. Their speeches were received with the most enthusiastic applauses by the Assembly and the galleries, and their proposals were decreed by acclamation without a vote. No nation is so much led by the influence of sudden emotions as the French. The patriotic contagion now spread fast through every breast, and a contest of generosity ensued. The hereditary jurisdictions possessed by the nobles within their own territories were next sacrificed. All places and pensions granted by the court were suppressed, unless granted as the reward of merit or of actual services.

249 The game laws, &c. abolished.

The game laws, which condemned the husbandman, under severe penalties, to leave his proper-

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ty a prey to infinite multitudes of animals reserved for pastime, had always been numbered among the severe grievances of the French peasantry. These were therefore renounced, along with the exclusive rights of rabbit warrens, fisheries, and dovecots. The sale of offices was abolished, and the fees exacted from the poor, together with the privilege of holding a plurality of livings, were relinquished by the clergy. The deputies of the *Pais d'Etat*, or privileged provinces, with the deputies of Dauphiné at their head, next came forward, and offered a surrender of their ancient privileges, requesting that the kingdom might no longer remain parcelled out among Dauphinois, Bretons, Provençaux, &c. but that they should all form one great mass of French citizens. They were followed by the representatives of Paris, Marseilles, Lyons, Bourdeaux, Strasbourg, &c. who requested leave to renounce all their separate privileges as incorporations, for the sake of placing every man and every village in the nation upon a footing of equality. Thus the assembly proceeded, till every member had exhausted his imagination upon the subject of reform. To close the whole, the Duc de Liancourt proposed that a solemn *Te Deum* should be performed, that a medal should be struck in commemoration of the events of that night; and that the title of RESTORER OF GALLIC LIBERTY should be bestowed upon the reigning monarch. A deputation was accordingly appointed to wait upon the king, respectfully to inform him of the decrees.

250 ny an- nt privi- es are untarily render-

251 Tithes and revenues of the clergy taken away.

Several succeeding days were necessary to form into laws the decrees of the 4th August, and committees were appointed to make out reports for that purpose. One of these reports having included the tithes and revenues of the clergy among the abuses that were to be done away, and having proposed in lieu of them to grant a certain stipend to the different ministers of religion to be payable by the nation, the clergy attempted to make a stand in defence of their property, and violent debates ensued. In these they were ably supported by the Abbe Sieyes: but as the clergy had formerly deserted the nobles, so they were now in their turn abandoned to their fate by the hereditary aristocracy. The popular party had long regarded the wealth of the church as an easy resource for supplying the wants of the state.— Never was there a more complete proof of the influence of opinion over the affairs of men. The Catholic clergy of France, though possessed of more property than they enjoyed at the time when princes took up arms or laid them down at their command, now found so few defenders, that they were terrified into a voluntary surrender of all that they and their predecessors had possessed for ages. In their overthrow, they scarcely enjoyed even the barren honour of having fallen the last of those privileged orders that so long had ruled over this ancient kingdom. They and the nobles, and the king, still possessed their former titles and nominal dignity; but all of them were now subdued, and at the mercy of the commons of France, who speedily dismissed them at their pleasure.

252 A new ministry appointed.

As a short season of tranquillity in the Court and the National Assembly succeeded these great popular sacrifices, the king laid hold of it as a fit opportunity for the appointment of a new ministry. They consisted of the archbishop of Vienne, the archbishop of Bourdeaux, M. Neckar, the Count de St Priest, Count de Montmorin, the Count de la Luzerne, and the Count de la Tour du Pin Paulin. M. Neckar, as minister of finance, having stated the distressed situation of the revenue, presented the plan of a loan of thirty millions of livres. But M. Mirabeau, from a spirit of rivalship, as it would seem, to M. Neckar, prevailed with the assembly to alter and to narrow the conditions of it in such a degree that very few subscribers were found, and the loan could not be filled up. This failure involved the assembly in a considerable degree of unpopularity: in consequence of which they allowed M. Neckar to prescribe his own terms for the purpose of obtaining a loan of eighty millions. But the happy instant of public confidence had been allowed to pass away, and this loan was never more than half filled up. Recourse was next had to patriotic contributions; and great numbers of gold rings, silver buckles, and pieces of plate, were presented to the assembly. The royal family themselves sent their plate to the mint, either to give countenance to these donations, or, as M. Neckar has since asserted, through absolute necessity, for the purpose of supporting themselves and their family. The confusion into which the nation had been thrown by the late events had produced a suspension of the payment of all taxes. There existed, in fact, no efficient government; and if society escaped entire dissolution, it was merely in consequence of those habits of order which are produced by a state of long continued civilization. The business of government could not be transacted without money, and many vain efforts were made by the ministry to procure it. At length M. Neckar was driven to the desperate resource of proposing a *compulsory loan*, or that every individual possessed of property should advance to the state a sum equal to one-fourth of his annual income. This bold proposition was supported by Mirabeau, and adopted by the assembly; but it does not appear to have ever been effectually executed.

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253 Who find great difficulty in raising money.

254 Discussion on the *Rights of Man*,

In the mean time, the assembly was busily occupied in framing the celebrated declaration of the *Rights of Man*, which was afterwards prefixed to the new constitution. This was followed by the discussion of a point of much delicacy and difficulty; viz. What share of legislative authority the king ought to possess under the new constitution: whether an absolute negative or *veto*, a suspensive *veto*, or no *veto* at all? This question operated like a touchstone for trying the sentiments of every person; and the assembly, consisting of 1200 men, was now seen to arrange itself into two violent contending factions. The debates were vehement and tumultuous, and continued for many days. As the assembly sat in public, and as multitudes of people of all descriptions were admitted into the galleries, and even into the body of the hall among the members, many indecent scenes took place in consequence of the interference of the spectators to applaud or censure the sentiments which were delivered. Thus the public at large became speedily interested in the discussion; the city of Paris took a side in opposition to the *veto*, and the whole empire was thrown into agitation by new and speculative questions. The distinguished place which France holds among the nations of Europe rendered these singular events and discussions the object of universal attention. The contagious love of novelty spread rapidly abroad, and gave rise to that well-founded jealousy on the part of the monarchs of Europe, which was

255 and the king's *veto*.

was speedily to burst forth in a bloody tempest.—In the present case, the people of Paris became most eagerly interested. Rumours of plots were spread through the country, and a new storm was obviously gathering, when the question was thus got quit of. M. Mounier remarked, that the executive power could possess no negative against the decrees of the present assembly, which had been nominated by the nation with supreme powers for the express purpose of framing a constitution, which was to remain binding over all orders of men in the state; and with regard to future legislatures, the king declared by a message, that he wished to possess no more than a *suspensive veto*. It is remarkable that the popular Mirabeau concluded a speech in favour of the absolute *veto* of the crown with these words, "That it would be better to live in Constantinople, than in France, if laws could be made without the royal sanction." This political adventurer is, however, accused of having taken care to circulate in Paris a report that he had opposed the *veto* with all his influence; and to give credit to the story, he is said to have quitted the assembly just before the division, that his vote might not appear on record against it.

256 Discussion about the legislative body, whether it ought to consist of one or two chambers.

The month of August was spent in the debates about the *veto*; and in the beginning of September a new constitutional question was presented to the assembly by one of its numerous committees. This was, Whether the legislative body, ought to consist of one or of two chambers? Mounier, Lally Tollendal, Clermont Tonnerre, and others, who were zealous lovers of freedom upon what were then accounted moderate principles, supported eagerly the idea of establishing two independent chambers in imitation of the British constitution; but they were deserted both by the democratic and aristocratic parties. The first of these regarded an upper house or senate as a refuge for the old aristocracy, or as the cradle of a new one; while the higher nobles and clergy feared lest such an arrangement might prevent the future re-establishment of the ancient division into three orders. Of 1000 members who voted, only 89 supported the proposal for dividing the legislature into two chambers.

257 The royal sanction granted to the decrees of the 4th August, &c.

Soon after this the king gave his sanction to the important decrees of the 4th of August, but not without some hesitation, and expressing doubts of the wisdom of some of them in a letter to the assembly. At the same time the *inviolability* of the person of the monarch was decreed, the indivisibility of the throne, and its hereditary descent from male to male in the reigning family. But we shall not here attempt to enter into a detail of the various articles of the new constitution as connected with the circumstances under which they became the subject of debate. We shall only state those more remarkable circumstances which tend to ascertain the peculiar changes which the sentiments of the nation underwent in the progress of a revolution the most remarkable that occurs in human history.

258 State of parties in Paris.

In consequence of the debates upon the questions of the *veto* and the two chambers, the minds of parties had become much irritated. Paris wore the same threatening aspect that it had done in the months of June and of July preceding; and every thing seemed tending towards an important crisis. The aristocratic party accused their antagonists of a design to excite new insurrections; and the charge was retorted, by circulating a report that a plot for conveying the king to Metz was already ripe for execution.

259 Conseque ces of th mutual j lousies.

From the period of the defection of the French guards, who were now in the pay of the capital, the protection of the royal family had been entrusted to the militia or national guard of Versailles, together with the regiment of the *gardes du corps*, which was composed entirely of gentlemen. Upon the circulation of the report of the intended flight of the king, the French guards began to wish to be restored to their ancient employment of attending his person, for the purpose of preventing any attempt of this nature. This idea was eagerly cherished by the capital; and, in spite of every effort used by M. de la Fayette, the obvious appearance of approaching disturbances could not be prevented. The popular party saw the advantages which they would derive from placing the assembly and the king in the midst of that turbulent metropolis which had given birth to the revolution, and upon the attachment of which they could most securely depend. Every encouragement was therefore given by the most active leaders of what was now called the *Democratic* party to the project of establishing the court at Paris. The ministry were under no small degree of alarm; and the count d' Estaing, who commanded the national guard of Versailles, requested the aid of an additional regiment. The regiment of Flanders was accordingly sent for: its arrival caused no small degree of anxiety; and every effort was instantly made to gain over both officers and soldiers to the popular cause.

On the first of October the gardes du corps, probably for the purpose of ingratiating themselves with the newly arrived regiment, and perhaps to attach them more steadily to the royal cause, invited the officers of the regiment of Flanders to a public entertainment. Several officers of the national guard, and others of the military were invited. The entertainment was given in the opera house adjoining to the palace; several loyal toasts were drank: but it is asserted, that when the favourite popular toast *The Nation* was given, it was rejected by the gardes du corps. In ordinary cases, such a trifling circumstance as this, or even any other of the transactions of a night of festivity, would justly be regarded as unworthy of notice in recording the more remarkable events in the history of a great nation; but such was now the singular state of affairs, that the most trivial occurrences were instrumental, by their combination, in the production of important consequences. The queen, having seen from a window of the palace the gaiety which prevailed among the military, prevailed with the king, who was just returned from hunting, to visit them along with herself and the dauphin. Their sudden appearance in the saloon kindled in an instant the ancient enthusiasm of French loyalty. The grenadiers of the regiment of Flanders along with the Swiss chasseurs, had been admitted to the dessert; and they, as well as their officers, drank the health of the King, Queen, and Dauphin, with their swords drawn. The royal family having bowed with politeness to the company, retired. Of all nations, the French are most liable to the influence of sudden impressions: the music played the favourite air, *O, Ricard! O mon Roi! l'univers t'abandonne*, "O Richard! O my king! the world abandons thee." In the eagerness of loyalty

loyalty, the national cockade, which had been adopted by some of the gardes du corps, was thrown aside, and white cockades were supplied as quickly as they could be made by the ladies of the court.

When these events were next day reported at Paris, accompanied by a multitude of exaggerations, they gave rise to the most violent alarm. The capital was at that time suffering all the horrors of famine; and in such a situation, the news of a feast which others have enjoyed, seldom gives much pleasure to hungry men. To the former report of an intended flight on the part of the royal family, it was now added, that a counter revolution was speedily to be attempted by force of arms; and that the present scarcity was artificially created by the court for the purpose of reducing the people to submission. Their aristocratic antagonists have since asserted, that the famine was indeed artificial; but that it was created by a portion of the violent party in the national assembly, which was then denominated the *Cabal*, whose object was to excite commotions as the means of procuring an opportunity of setting the duke of Orleans at the head of the state, either as regent, or in some other form. To this last party Mirabeau is said to have belonged.

For four days no notice was taken in the assembly of what had passed at the entertainment given by the gardes du corps. On the 5th of October M. Petion mentioned it for the first time, and a violent debate ensued; during which Mirabeau rose and exclaimed, "Declare that the king's person *alone* is sacred, and I myself will bring forward an impeachment;" thereby alluding to the conduct of the queen. While this de-

260 A multitude of women of the lowest rank march to Versailles.

bate was proceeding at Versailles, the city of Paris was in commotion. A vast multitude of women of the lowest rank, with some men in women's clothes, had assembled at the *Hotel de Ville*, and were calling aloud for arms and bread. They resolved to proceed instantly to Versailles to demand bread from the king and from the national assembly. La Fayette opposed them in vain; for his own soldiers refused to turn their bayonets against the women. Upon this one Stanislaus Maillard, who had distinguished himself at the taking of the Bastile, offered himself as a leader to the insurgents. He had the address to prevail with them to lay aside such arms as they had procured; and he set out for Versailles about noon with as much order among his followers as could well be expected from such an assemblage. Either because the passion for going to Versailles had suddenly become too infectious to be resisted, or because the multitude already gone thither was now accounted dangerous, the mayor and municipality of Paris thought fit to give orders to La Fayette instantly to set out for that place at the head of the national guard.

In the mean time, Maillard approached Versailles with his tumultuous troop; he arranged them in three divisions, and persuaded them to behave with tolerable decency. The king was hunting in the woods of Mendon when he was informed of the arrival of a most formidable band of women calling aloud for bread. "Alas! (replied he) if I had it, I should not wait to

261 and send a deputation to the assembly.

be asked." Maillard entered the assembly accompanied by a deputation of his followers to state the object of their journey. The assembly, to pacify them, sent a deputation of their own number along with them to lay their complaints before the king. His majesty received the whole with great politeness, and readily agreed to go into any measures for the supply of the capital that could be suggested. The report of this behaviour had such an effect upon the multitude collected around the palace, that they began to disperse; but they were speedily succeeded by another crowd not less numerous. A sudden resolution of flight seems now to have been proposed by the court; for the king's carriages were brought to the gate of the palace which communicates with the orangery: but the national guard of Versailles refused to allow them to pass, and the king himself refused to remove, or to allow any blood to be shed in his cause.

262 La Fayette with his army reaches Versailles at night.

La Fayette with his army at length arrived about 10 o'clock at night, and found the assembly in a very unpleasant situation. Their hall and galleries were crowded by the Parisian fish-women and others of the mob, who, at every instant, interrupted the debates. La Fayette waited upon the king, and informed him of the proceedings of the day, planted guards in every quarter; and after a scanty banquet had been procured for the multitude, he prevailed with the assembly to close their sitting for the night. In this last part of his conduct M. la Fayette has been much censured, and probably not without reason; for it could scarcely be expected that such a night would be spent in peace by the immense assemblage of turbulent characters that

263 Desperate attempt on the queen.

were now brought together. All was quiet, however, till about six in the morning of the 6th, when a great number of women and desperate persons rushed forward to the palace, and attempted to force their way into it. Two of the gardes du corps were killed; the crowd ascended the stair leading to the queen's apartment, but were bravely resisted by M. Miemandre a sentinel, who gave the alarm, and defended his post till he fell covered with wounds, of which, however, he afterwards fortunately recovered. The ruffians, reeking with his blood, rushed into the chamber of the queen, and pierced with bayonets and poniards the bed whence this persecuted woman had but just time to fly almost naked, and, through ways unknown to the murderers, had escaped to seek refuge at the feet of the king, who was already alarmed, and had gone to seek her.

264 The royal family saved by Fayette.

The tumult became more violent every moment, and sudden death seemed to threaten the royal family; but La Fayette was by this time at the head of his troops, whom he beseeched earnestly to save the gardes du corps from massacre. In this he was successful; some that had been taken prisoners were surrounded by the grenadiers of the French guards, who protected them, and the retreat of the whole corps was easily secured. The crowd was speedily driven from the different quarters of the palace, which they were already beginning to pillage; and the royal family ventured to show themselves at a balcony. A few voices now exclaimed, *Le Roi à Paris*, "the King to Paris." The shout became general; and the king, after consulting with La Fayette, declared that he had no objection to take up his residence at Paris, provided he was accompanied by the queen and his children. When the proposal was reported to the assembly, the popular leaders expressed much satisfaction. They ordered a deputation of 100 members to attend the king thither; they voted the national assembly inseparable from the king. His majesty set

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265 Are carried prisoners to Paris. set out at two o'clock a prisoner in the custody of the mob. Two gentlemen were selected from his body guard, and, with all the parade of an execution, beheaded in the court of his palace. Their heads were stuck upon spears, and led the procession; whilst the royal captives who followed in the train, and beheld this spectacle, were conducted so slowly, that a short journey of twelve miles was protracted to six hours. The king, the queen, and their children, were lodged in the old palace of the Louvre, while Monsieur went to reside at the Luxemburg. The city was illuminated, and the evening spent in triumph by the Parisians.

266 Triumph of the popular party. The removal of the king to Paris was regarded as a triumph by the popular party. The higher order of nobles considered it as completely ruinous to their hopes; and even many men of talents, such as Mounier and Lally Tollendal, whom we cannot avoid regarding as friends to the popular cause in its outset, now regarded every prospect of attaining a happy constitutional freedom as at an end, as the national representatives must be for ever exposed to the insults, and overawed by the influence of a turbulent capital. Many members of the assembly took refuge in foreign countries, and used every effort to excite the other nations of Europe to hostility against France. As the duke of Orleans had been regarded as a chief agent in promoting the late disturbances, the marquis de la Fayette waited upon him, and insisted upon his leaving the kingdom for a time. The duke was overawed, and, on pretence of public business, went to England, where he remained for several months.

267 The assembly holds its first session at Paris. On the 19th of October, the National Assembly held its first session in Paris. The king was closely guarded in his own palace; and no apparent opposition now stood in the way to prevent the popular party from giving to their country such a constitution as they might judge expedient. Much, however, was yet to be done, and many difficulties remained, resulting from the habits of men educated under a very different order of things. Two days after the assembly came to Paris, a baker was publicly executed by the mob, upon a false accusation of having concealed a quantity of bread.—While the assembly was at a distance, events of this nature had been little attended to, and the leading party avoided attempting to check these ebullitions of popular violence, from which they had derived so much advantage; but that party was now all powerful, and so flagrant an offence committed against the law was regarded as an insult upon the sovereignty of the National Assembly. Two leaders of the mob were therefore tried and publicly executed, and a severe law was passed, of the nature of the British riot act, authorising the magistrates to act by military force against any multitude of persons that should refuse to disperse. Thus the peace of the capital was secured for several months; but in the country at large no small degree of anxiety and trouble still subsisted. The same suspicious temper which had prevailed at Paris agitated the provinces with the dread of plots and monopolies of grain. Add to this, that the noblesse in the country were by no means satisfied with the liberality with which their representatives had on the 4th of August voted away their privileges and their property. This produced violent jealousies between the peasants and their lords, and gradually conveyed to every corner of the kingdom the political ferment which had commenced at Paris.

268 The kingdom divided into 83 departments. The National Assembly being now, however, in tolerable security, proceeded in the arduous attempt of forming a free constitution for the great empire of France. The Abbe Sieyes presented a plan for dividing the kingdom into 83 *departments*, of about 324 square leagues, and each department into several *districts*, and each district was subdivided into *cantons* of four square leagues in extent. Thus the whole of the ancient divisions of the kingdom into governments, generalities, and bailiwicks, was in an instant obliterated. An attempt was also made to simplify in an equal degree the relative situation of individuals in civil life, by a decree which put an end to all distinction of orders and immunities, so far as any privileges whatever was concerned. At the same time, a bold and most important measure was adopted, which has since proved the organ of those terrible efforts which France has

269 The church lands confiscated. been enabled to make against the rest of Europe. This was the confiscation of the whole of the lands belonging to the church, for the purpose of supplying the exigencies of the state. In this transaction, all regard to justice was thrown aside. The lands of the church were as certainly the property of the then possessors of them as any entailed estate among us is the property of him who occupies it. The state may have had a right to appropriate to itself the church lands upon the death of the incumbents; but it might with equal justice, and perhaps greater propriety, have seized the enormous revenues of the duke of Orleans, as have confiscated a single acre belonging to the most useless abbot without his own consent. This nefarious measure was proposed by the bishop of Autun, M. Talleyrand Perigord, a man of no religion, who had been promoted to the bench in a most irregular manner to serve this very purpose. The mode in which this property was to be expended was by issuing assignments (*assignats*) upon it; which assignments were to be received by the state for the payment of taxes, or for the purchase of church lands when set up to sale. A provision was at the same time made for the national clergy, who were for the future to be paid by the state. On the day following that on which this important measure was adopted, a decree was passed, suspending the parliaments of the kingdom from the exercise of their functions.

270 Fruitless attempt of the parliament. Decrees, in which the interests of so vast a multitude of individuals were involved, could not be carried into effect without much murmuring and opposition. The parliaments, in particular, began to exert themselves with vigour, and, by protests and other publications, attempted to invalidate the decrees of the assembly as illegal; but these privileged bodies, who had often been accustomed to contend with some success against the despotic administration of their country, and on that account had been for ages the objects of public applause, now found themselves utterly forsaken, and unable to resist the mandate of a popular assembly. After a few fruitless struggles, they were all of them under the necessity of submitting to their fate.

271 Municipalities established. Nothing remarkable now occurred for some time.—The assembly proceeded to organize the kingdom by the establishment of municipalities, and by reforming the jurisprudence of the country. It is to be observed, however, that when the parliament of Paris was abolished,

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lished, the Chatelet, being the second court in that city, was retained for the purpose of trying those persons who had become most obnoxious by their attachment to the royal cause. This court had the spirit to acquit the Baron de Bezenval, Marshal Broglio, and the Prince de Lambesq. But having incurred much popular odium on this account, they were guilty of the unworthy meanness of condemning to death the Marquis de Favres, for a pretended conspiracy (of which no tolerable proof was ever brought) to massacre La Fayette, Bailly, and Neckar, and to convey the king to Peronne.

1790. During the whole of this winter the king had been very strictly watched by numerous guards placed round his palace, insomuch that the other nations of Europe considered him as in a state of captivity. To do away this impression, if possible, and to make their king appear a voluntary agent in the measures that had lately been adopted, was now regarded as a matter of some importance. Every effort was therefore made to prevail with him to come to the assembly suddenly, and, as it were, of his own voluntary motion, there to declare his adherence to the measures which had lately been adopted. For some time he resisted this proposal; but at length, on the 4th of February, he did suddenly appear in the national assembly, where he complained of the attempts that had been made to shake the new constitution. He declared his wish "that it should be universally known that the monarch and the representatives of the nation were united, and their wishes were the same; that he would defend the constitutional liberty of the state; that, in conjunction with the queen, he would early form the sentiments of his son for that new order of things which the circumstances of the empire had introduced." This declaration dispirited the aristocratic party in no small degree, and increased that unhappy tendency of looking for aid from foreign countries which they had always been too apt to indulge.

272 Monasteries suppressed, and their lands confiscated.

On the 13th of February, monastic establishments were suppressed, and their lands confiscated; but the present friars and nuns were allowed pensions for their subsistence, and to continue the observance of their monastic vows, if they thought fit. We may observe here, that, in consequence of the evacuation of the monasteries, it is probable that about this time the *Breton* committee began to assume the appellation of the *Jacobin Club*, from the hall belonging to the Jacobin friars at Paris, in which their meetings were now held.

March 13th 273 The Red Book or list of pensions and donations, published.

An event occurred at this time which tended in no small degree to increase the odium under which the old government already laboured. This was the publication of the *Red Book*, or list of pensions and donations granted by the crown. In consequence of the most pressing instances, it had been communicated by M. Neckar to a committee of the assembly, after many entreaties, and the most solemn promises of secrecy. It afforded, however, too striking an advantage to the popular party not to be made use of, and in a few days M. Neckar, to his no small surprise, saw this register publicly sold by every bookseller in Paris. He ought not, indeed, to have been surprised; and the giving up of this list is one of the many proofs which the transactions of that period afford of his great unfitness for the office which he held. With much indignation, however, he demanded why the committee had published it without the permission of the assembly or the king? But he was told by the committee, that "as to the assembly, they were sure of its approbation; and as to the king, they were not his representatives." To give an idea of the effect of this publication, it is only necessary to remark, that, under the short administration of M. Calonne, the two brothers of the king had received from the public treasury, independent of their legitimate income, nearly two millions sterling, and that 600,000l. had been granted to an individual, because he was the husband of Madame de Polignac. M. Neckar's opposition to this publication tended in no small degree to injure his popularity, and the rest of the ministry began to lose the confidence of the public. Indeed, at this time, fertile causes of alarm prevailed on all sides. The clergy were attempting to revive in the provinces the ancient animosities between the Roman Catholics and the Protestants, ascribing the late decrees of the assembly to the latter. The German princes who possessed property in the north of France were complaining loudly of the violation of their rights by the abolition of the feudal system, although the national assembly had voted to them a compensation. The most melancholy intelligence was received from their colonies in the West Indies. In regulating these, the assembly had not recognized the right of the free negroes to enjoy the same privileges with other citizens; at the same time, they did not go the length of denying these privileges. This uncertain conduct produced infinite calamities. The whites contended with those commonly called *people of colour*. These again sometimes stood in opposition to the free negroes, or to the slaves; and hence it sometimes happened that no less than three hostile assemblies were held at the same time in the same colony, which made war upon each other with the most inveterate fury. Each party found protectors in the national assembly of the parent state. Those who favoured or opposed the existence of distinctions at home, in general followed out the same principle with regard to the colonies.

274 Effect of its publication.

275 Numerous sources of alarm.

276 Debate on the royal power to declare peace and war.

On the 14th of May, M. de Montmorency communicated to the national assembly the preparations for war in which England and Spain were engaged. This brought forward the constitutional question, "Who ought to possess the power of declaring peace and war? The Count Clermont Tonnerre, Messrs de Serent, Virieu, and Dupont, supported the royal prerogative; while on the other side, the exclusive right of the legislative body to exercise this important prerogative was supported by Messrs d'Aiguillon, Garat, jun. Freteau, Jellot, Charles Lambeth, Sillery, Petion, Robespierre, &c. M. Petion proposed a decree "that the French nation renounced for ever all idea of conquest, and confined itself entirely to defensive war;" which was passed with universal acclamation. The Count de Mirabeau at length successfully proposed that peace and war should be declared by the king and the legislative body in conjunction; and the decree that was passed on the subject is a strange farrago of contradictions and absurdities. It enjoined the king to "guard the state from external attacks." But how could this be done without repelling any attack that might be made upon it? This, however, he could not do, without previously informing the national assembly; and if that body chanced not

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not to be sitting at the time, he was bound to let the enemy advance without opposition, till he had convened his orators, dispersed over 20,000 square leagues, and listened to their metaphysical quibbles in Paris.

277 Farce acted in the assembly by a Prussian refugee, &c.

On the 16th June, a very singular farce was acted in the assembly. A Prussian refugee, who called himself Anacharsis Clouts, and who was struggling hard to bring himself into public notice, on an evening sitting (which, it is to be observed, was generally ill attended by the persons of the highest rank), introduced to the assembly a number of persons dressed in the different habits of all the different countries that could be thought of. In a formal harangue, he told the assembly that he was come, as the *orator of the human race*, at the head of the representatives of all nations, to congratulate them upon the formation of their new constitution. He was answered by the president with abnndance of solemnity, and retired with his motley groupe. This fantastical piece of folly, which in any other country than France would scarcely, perhaps, have excited a smile, was treated by the assembly in a serious light. Alexander Lambeth proposed, that the figures of different nations exhibited in chains at the feet of Louis XIV. should be destroyed as an insult upon mankind.

278 Abolition of hereditary titles.

M. Lambel, a lawyer, at this moment proposed the *abolition of all hereditary titles*. He was supported by La Fayette, St Fargeau, and the Viscount de Noailles. The decree was passed, along with another suppressing all armorial bearings. It is our intention at present rather to state facts than to hazard any political opinion concerning the wisdom or folly of the transactions which we record. It may here, however, be remarked, that no part of the proceedings of the French national assembly was received by persons of rank upon the continent of Europe with so much indignation as this. —The feudal system had been overturned, and the property of the church wrested from it, with little comparative notice; but when those nominal distinctions were attacked which antiquity had sanctioned, and personal vanity rendered dear, the surrounding nations were instantly alarmed, and beheld with terror the levelling precedent. We may likewise add, that no part of their proceedings was more inimical to rational and practical freedom. To preserve a perfect equality of ranks is impossible. In a commercial nation, industry will procure wealth, and wealth will every where procure dependents. Now nothing more contributes to keep within some tolerable bounds the insolence of newly acquired wealth, than the rank attached to birth and nobility, which time and prejudice have conspired to make respectable. It is not a little remarkable, that of all the king's ministers, Neckar alone, a plebeian, a republican, born and bred in a democracy, advised his majesty to refuse his assent to this foolish decree, as a violent but useless encroachment upon the prejudices of a powerful order of the state.

279 Proposal to commemorate the taking of the Bastile.

In the mean time, the capital was entirely engrossed by hurry and bustle. M. Bailly had proposed a plan for commemorating the anniversary of the taking of the Bastile. It was adopted, because it flattered the vanity of the people, by presenting them with a splendid spectacle in commemoration of their own exertions. —The army had been much disorganized; and it was resolved to attempt to unite all its branches, as well as the whole departments of the state, in one common attachment to the new order of things, by collecting into one place deputations, for the purpose of swearing fidelity to the new constitution.

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280 Ceremony of the confederation.

In the middle of the Champ de Mars an altar was erected, at which the civic oath, as it was called, was to be taken. Around the altar an amphitheatre was thrown up capable of containing 400,000 spectators: 2000 workmen were employed in this operation; and the people of Paris fearing lest the plan might not be completed, assisted in the labour. All ranks of persons, the nobles, clergy, and even ladies, with the eagerness for novelty so peculiar to that people, united their efforts. Crowds of foreigners as well as natives hurried to the capital to be present at this solemnity, which was called the *Confederation*. The long-expected 14th of July at length arrived. At six o'clock in the morning the procession was arranged on the Boulevards, and consisted of the electors of the city of Paris, the representatives of the commons, the administrators of the municipality, a battalion of children, with a standard, inscribed "The hopes of the nation;" deputies from the troops of France wherever quartered, and of every order, along with deputies from all the departments; to these were added immense detachments of the military, and of the national guards, along with an almost infinite multitude of drums, trumpets, and musical instruments. The procession was extremely splendid, as every district had its peculiar decorations. The national assembly passed through a grand triumphal arch, and the king and queen, attended by the foreign ministers, were placed in a superb box. After a solemn invocation to God, the king approached the altar, and, amidst the deepest silence, took the following oath: "I the king of the French do swear to the nation, that I will employ the whole power delegated to me by the constitutional law of the state, to maintain the constitution, and enforce the execution of the law." The president of the national assembly then went up to the altar, and took the civic oath, "I swear to be faithful to the nation, the law, and the king; and to maintain with all my powers the constitution decreed by the national assembly, and accepted by the king." Every member of the assembly standing up, said, "That I swear." La Fayette then advancing, took the oath for himself; the other deputies of the national guards pronouncing after him, "That I swear;" and these words were solemnly pronounced by every individual of this immense assembly. *Te Deum* was then sung. The performance was sublime beyond the powers of description. Never perhaps before was there such an orchestra, or such an audience: their numbers baffled the eye to reckon, and their shouts in full chorus rent the skies. It is impossible to enumerate all the means which were employed to add splendor to this day. It ended with a general illumination, and no accident disturbed the public tranquillity.

281 The soldiers at Nancy disgusted, & the consequences.

The assembly now proceeded in the formation of the constitution with considerable tranquillity; which, however, was disturbed by an unhappy event at Nancy. Most of the officers of the army were unfriendly to the late revolution, and every means had been employed by them to disgust the soldiers with it. At Nancy, in particular, necessaries had been denied them, and their pay was kept back, under pretence that this was the will of the national assembly. Driven to despair, the regiments in garrison threw off their allegiance, and demanded

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manded loudly the regimental accounts. They seized at the same time the military chest, and sent a deputation to state their case at Paris to the national assembly. But the officers were before-hand, and prepossessed the minister of war against them; upon whose representation a decree was passed, authorising the commander in chief of the province, M. Bouillé, to reduce the insurgents by force. This was no sooner known, than the national guard of Nancy assembled, and sent a deputation to give a fair statement of facts. But Bouillé, without waiting the result of an explanation, hastened to Nancy at the head of all the troops he could suddenly collect; and having fallen upon the regiments of Chateauvieux and Mestre de Camp, after putting an immense multitude to the sword, he took 400 prisoners.

The king's regiment was prevented from acting against Bouillé by the intrepidity of a young officer of the name of *Dessiles*, who, however, died of the wounds which he received on the occasion. The news of these events filled Paris with indignation. The assembly afterwards reversed its own decrees against the insurgents at Nancy. Public honours were decreed to the memory of Dessiles; but Bouillé could not be punished, because he had only acted in obedience to authority.

282 M. Neckar resigns, and leaves the kingdom without being regretted.

M. Neckar's popularity had been gradually declining, as he was unwilling to go all the lengths that the ruling party wished. He gave in his resignation on the 4th of September, and speedily thereafter left the kingdom. He was regretted by no party. He was regarded, on the one side, as having conducted the kingdom to its ruin, by the concessions which he originally advised the king to make in favour of the *tiers etat;* while he was despised by the opposite party as a lukewarm politician, of narrow views, and a feeble mind. He departed, however, with the unblemished reputation of strict integrity. M. Neckar does not seem to have penetrated deeply into the characters of men, or to have had any conception of the effects of that terrible and restless energy which is called forth in a nation which attempts to make important changes in its ancient manners and government. Having no conception of the important era which was about to open upon that country of which he was the minister, he was far from being qualified to direct or controul it amidst the convulsions which it was destined to encounter. Unable to brook the loss of his popularity, he peevishly retired to Swisserland, where he published a work, which shews to the conviction of every unprejudiced reader the integrity of the French king, and the wicked projects of the leading democrats, whom he himself had armed with power.

283 Attempts to reorganize the navy.

The remaining part of this year was occupied in attempts to introduce some degree of subordination into the navy of France, which had been much disorganized, and in farther regulating the affairs of the clergy. It was now declared, that such clergymen as should not take the following oath, which had been prescribed some months before, should be considered as ejected from their benefices: "To watch carefully over the faithful in the parish or diocese which was entrusted to his care; to be faithful to the nation, the law, and the king; and to maintain to the utmost of his power the new constitution of France, and particularly the decrees relative to the civil constitution of the clergy." This decree rendered the situation of conscientious men extremely perplexing; especially as the pope testified in marked terms his disapprobation of the oath. The people were reduced to the dilemma of choosing between their new political and their old religious prejudices, and the result was extremely unfavourable to the interest of religion.

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284 Hostile appearances in Germany, &c.

The assembly commenced the new year with a decree, announcing the termination of its session, which was to take place as soon as it should have finished the discussion of a list of constitutional articles. In the mean time, on the side of Germany, Spain, Italy, and Savoy, hostile appearances began to be exhibited, and bodies of troops advanced around the French frontier. The emperor Leopold was, however, too cautious to announce his intentions; and the king soon communicated a letter from him, containing protestations of amicable dispositions, but adding, that "the innovations occasioned by the decrees of the 4th of August ought to be done away." The king treated this merely as an official measure on the part of the emperor, that he might not appear to renounce the claims of certain German princes connected with Lorrain and Alsace. But the assembly expressed some alarm, and voted an augmentation of the national force. About this period several new efforts were made by the disaffected clergy in various parts of the kingdom to excite disturbances, which it is unnecessary to mention in detail.

285 Departure of the king's aunts from Paris.

On the 20th of February the public attention was roused by a circumstance that in any other state of affairs would have been accounted unimportant. The king announced to the assembly, that his aunts, the daughters of Louis XV. had that morning left Paris; but as he did not apprehend that the existing laws laid them under any restraint in this respect, he had not opposed their departure. After some debate, the assembly agreed that the king had judged well; and these princesses were left to pursue their journey to Rome, which they reached after some delays occasioned by the jealousy of certain municipalities through which they passed. Thus the kingdom was gradually deserted by every branch of the royal family, excepting the king and his eldest brother Monsieur. The assembly, however, continued its labours with considerable quietness.

286 Death of Mirabeau.

In the end of the month of March died the celebrated M. de Mirabeau, at the age of 42 years; a man whose integrity has for many good reasons been much suspected, but whose political address and intrepidity, and whose splendid powers of eloquence, have been seldom equalled. He received from his countrymen at his death marks of respect unparalleled in modern history. During his short illness, his door was besieged by anxious citizens. A mourning of eight days was decreed by the assembly, and also a grand procession, which was attended by all the public functionaries. He was the first who was interred in the new magnificent Pantheon, consecrated to the reception of the remains of illustrious men. But his ashes were afterwards removed, in consequence of very clear proofs that he had not been incorruptible by money.

287 An emigrant army assembled on the borders of Alsace.

During the whole of this spring, much fear was entertained that some attempts at a counter revolution were about to be made. The emigrant army assembled on the borders of Alsace was reviewed by the prince of Condé. Their uniform was black, faced with yellow, with

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with a death's head, surrounded by a laurel wreath, on one cuff, and a sword on another; with the motto, "Conquer or die." The king was also surrounded by crowds of nonjuring priests and other disaffected persons. Thus, that popular jealousy which in every period of the revolution has strikingly marked the French character, was kept on the alarm. On the 18th of April, therefore, when the royal family was preparing to go to St Cloud to pass some days, a report was instantly spread that the king was about to fly from the country. The carriages were immediately surrounded by people. La Fayette drew out the national guard, but they refused to act. "We know (exclaimed they) that we are violating the laws, but the safety of our country is the first law." The king instantly went to the assembly, and with much spirit complained of the insult. He was answered respectfully by the president, and continued his journey. As the royal family had enjoyed a considerable degree of freedom for some time past, which was demonstrated by the unsuccessful opposition made to this journey—the present opportunity was embraced for intimating to foreign courts his acceptance of the constitution; and all obnoxious persons were dismissed from about his person. The breach of discipline on the part of the national guard on this occasion was so much resented by La Fayette, that he resigned his command. Paris was thrown into consternation; and it was not till after the most universal solicitation that he was prevailed upon to resume his office.

288 Jealousy of the people and military lest the king and his family should emigrate.

289 Behaviour of Bouillé on the frontiers.

About this time M. de Bouillé, to whom the protection of the frontiers was entrusted, was employing, as it is now said, every means in his power to render the country defenceless. The garrisons were left unprovided; disunion was spread among the national troops; they were removed from the frontiers, and their place was occupied by foreigners, wherever it could be done. The emigrants abroad, and their friends at home, were lying in wait for an opportunity of revolt;—when suddenly, on the 21st of June, it was announced from the Thuilleries, that the king, the queen, the dauphin, with monsieur and madame, had quitted the palace and the capital, without leaving any information of their intention or their route. The emotion excited by this news among the multitude was a mixture of consternation and rage. The national assembly, however, acted with much coolness. They instantly took upon themselves the government, and decreed their sittings permanent. They sent messengers, at the same time, in all directions, to attempt to lay hold of the fugitives. These had taken different routes. Monsieur and madame arrived safely at Brussels on the 23d. The king, queen, and their children, when they came to a considerable distance from the capital, were furnished by Bouillé with a guard of dragoons, under pretence of protecting treasure for the pay of the troops. At the distance of 156 miles, and when only a few leagues from the frontiers, they were arrested at St Menehould by the postmaster, M. Drouet, formerly a dragoon in the regiment of Condé. At half past seven o'clock in the evening the carriages stopt to change horses at his house; he thought he recollected the queen, and imagined that the king's face resembled the impressions stamped upon assignats. The escort of dragoons increased the suspicion. He suffered them to depart at 11 o'clock without notice; but taking a companion with him, he went by a shorter road to Varennes, With the assistance of the postmaster there he gave the alarm, and overturned a carriage on the bridge, which detained the royal travellers till the national guard of the place had assembled, and the arrest was effected without bloodshed. They were brought back to Paris by a deputation from the assembly. At his departure, the king had imprudently left beyond him a memorial, in which he declared, that he never had thought any sacrifice too great for the restoration of order; but that the destruction of the kingdom, and the triumph of anarchy, being the only reward of all his efforts, he thought it necessary to depart from it. He then takes a review of the faults of the new constitution, the grievances he has suffered; and protests against every thing that he had been compelled to do during his captivity.

290 The king, queen, and royal family, leave Paris.

291 Monsieur and madame arrive at Brussels.

292 The king and queen arrested at Varennes.

Different parties were very differently affected by this ill-conducted and unfortunate flight of the king. A small republican party had already begun to appear, and during the king's absence, attempts were made to induce the puplic at large to consider the royal authority as no necessary part of a free constitution. But the minds of men were by no means prepared for the reception of this new doctrine. The idea, however, having been thus publicly proposed, left some impressions, which in time contributed to give rise to important events. By far the greater number of leading men, however, were at present convinced, that it was impossible to conduct a great empire like France, well and prosperously, without the assistance of an hereditary chief. They therefore determined to pass over the affair with as much silence as possible, and to hasten the period when their new constitution should be complete. But there is reason to believe, that this journey was at the long-run highly instrumental in producing very fatal effects to the personal safety of the monarch.

293 Consequences of this unfortunate flight.

His flight seemed a signal for emigration. Many of the aristocratic party sent in resignations of their seats in the national assembly. Troops were levied on the frontiers in the king's name; who took care, however, to disavow any connection with such a procedure. Bouillé emigrated, and afterwards sent to the assembly a furious threatening letter: "You shall answer (says he) for the lives of the king and of the queen to all the monarchs of the universe. Touch but a single hair of their heads, and not one stone shall be left upon another in Paris. I know the roads. I will conduct the foreign armies. This letter is but the forerunner of the manifesto of the sovereigns of Europe."

A considerable calm throughout France followed these events, and it might be regarded as in a state of tranquillity. It contained, indeed, parties entertaining much animosity against each other, and many citizens had withdrawn to foreign countries; but the peace was not broken, and moderate men hoped that much prosperity would follow from the late agitations. But this calm was delusive; and in the midst of it those projects were formed which were afterwards to prove so fatal to the peace of France and of Europe. Towards the close of this summer, a convention took place at Pilnitz in Saxony between the emperor Leopold and the king of Prussia. Its object was not known at the time, but it gradually came into view, and is now by many understood

294 Treaty of Pilnitz.

stood to have been intended for the purpose of concluding a league for the invasion of France, the new-modelling of its government, and the partition of some of its fairest provinces. The following paper has been repeatedly published as the copy of a treaty concluded and signed at Pavia, and is generally understood to have been identical with, and therefore known by, the name of the *Treaty of Pilnitz.* We are far from vouching for its authenticity. It may have been fabricated by the French assembly, to unite all parties in the nation against the foreign powers which threatened to invade them. But in stating the events of this revolution, it is perhaps still more necessary, for the purpose of rendering the actions of men comprehensible, to give an account of what was at the time *believed* to have occurred, than it now is to ascertain what was actually true.

Partition Treaty between the Courts in Concert, concluded and signed at Pavia, in the month of July 1791.

His majesty the emperor will take all that Louis XIV. conquered in the Austrian Netherlands, will give them to his serene highness the elector Palatine; so that these new possessions, added to the Palatinate, may hereafter have the name of *Austrasia.*

His majesty will preserve for ever the property and possession of Bavaria, to make in future an indivisible mass with the domains and hereditary possessions of the house of Austria.

Her serene highness the archduchess Maria Christina shall be, conjointly with his serene highness her nephew the archduke Charles, put into hereditary possession of the duchy of Lorraine.

Alsace shall be restored to the empire; and the bishop of Strasbourg, as well as the chapter, shall recover their ancient privileges, and the ecclesiastical sovereigns of Germany shall do the same.

If the Swiss Cantons consent to accede to the coalition, it may be proposed to them to annex to the Helvetic league the bishopric of Porentrui, the defiles of Franche Comte, and even those of Tyrol, with the neighbouring bailiwicks, as well as the territory of Versoy, which intersects the Pays de Vaud.

Should his majesty the king of Sardinia subscribe to the coalition, La Bresse, Le Bugey, and the Pays de Gex, usurped by France from Savoy, shall be restored to him.

In case his Sardinian majesty can make a grand diversion, he shall be suffered to take Dauphiné, to belong to him for ever as the nearest descendant of the ancient dauphins.

His majesty the king of Spain shall have Roussillon and Bearn, with the island of Corsica; and he shall have the French part of the island of St Domingo.

Her majesty the empress of all the Russias shall take upon herself the invasion of Poland, and at the same time retain Kaminiech, with that part of Podolia which borders on Moldavia.

His majesty the emperor shall oblige the Porte to give up Chocsim, as well as the small forts of Servia, and those on the river Lurna.

His majesty the king of Prussia, by means of the above-mentioned invasion of the empress of all the Russias into Poland, shall make an acquisition of Thorn and Dantzic, and there unite the Palatinate on the east to the confines of Silesia.

His majesty the king of Prussia shall besides acquire Lusace; and his serene highness the elector of Saxony shall in exchange receive the rest of Poland and occupy the throne as hereditary sovereign.

His majesty the present king of Poland shall abdicate the throne on receiving a suitable annuity.

His royal highness the elector of Saxony shall give his daughter in marriage to his serene highness the youngest son of his royal highness the grand duke of all the Russias, who will be the father of the race of the hereditary kings of Poland and Lithuania. (Signed) LEOPOLD. PRINCE NASSAU. COUNT FLORIDA BLANCA. BISCHOFFSWERDER.

295 The new constitution concluded by the assembly.

In the mean time, the national assembly was hastening fast to the completion of the new constitution. It was finished on the 3d of September, and presented to the king. It begins with the following declaration of the rights of a man and a citizen: and thereafter follow the different branches; the chief of which are here translated.

I. All men are born, and remain, free and equal in rights: social distinctions cannot be founded but on common utility.

II. The end of all political associations is the preservation of the natural and imprescriptible rights of man: these rights are liberty, property, security, and resistance against oppression.

III. The principle of *sovereignty* resides essentially in the nation: *no body* of *men*, no *individual*, can exercise an authority that does not emanate expressly from that source.

IV. *Liberty* consists in the power of doing every thing except that which is hurtful to another: hence the exercise of the natural rights of every man has no other bounds than those that are necessary to ensure to the other members of society the enjoyment of the same rights: those bounds can be determined by the law only.

V. The law has a right to forbid those actions alone that are hurtful to society. Whatever is not forbidden by the law, cannot be hindered; and no person can be constrained to do that which the law ordaineth not.

VI. The law is the expression of the general will: all the citizens have a right to concur personally, or by their representatives, to the formation of the law: it ought to be the same for all, whether it protect, or whether it punish. All citizens being equal in the eye of the law, are equally admissible to dignities, places, and public offices, according to their capacity, and without any other distinction but that of their virtue and their talents.

VII. No man can be accused, arrested, or detained, except in cases determined by the law, and according to the forms which the law hath prescribed. Those who solicit, dispatch, execute, or cause to be executed, arbitrary orders, ought to be punished; but every citizen that is summoned or seized in virtue of the law, ought to obey instantly—he becomes culpable by resistance.

VIII. The law ought to establish such punishments only as are strictly and evidently necessary; and no person can be punished but in virtue of a law established and promulgated prior to the offence, and legally applied.

IX. Every man being presumed innocent till such time as he has been declared guilty, if it shall be deemed absolutely necessary to arrest a man, every kind of rigour employed, not necessary to secure his person, ought to be severely repressed by the law.

X. No person shall be molested for his opinions, even such as are religious, provided that the manifestation of those opinions does not disturb the public order established by the law.

XI. The free communication of thought, and of opinion, is one of the most precious rights of man. Every citizen, therefore, may freely speak, write, and publish, his sentiments; subject, however, to answer for the abuse of that liberty, in cases determined by the law.

XII. The guarantee of the Rights of Man and Citizens, involves a necessity of *public force:* this force is then instituted for the advantage of all, and not for the particular utility of those to whom it is confided.

XIII. For the maintenance of public force, and for the expences of administration, a common contribution is indispensably necessary: this contribution should be equally divided amongst all the citizens, in proportion to their abilities.

XIV. Every citizen has a right, by himself, or by his representatives, to decide concerning the necessity of the public contribution; to consent to it freely; to look after the employment of it; to determine the quantity, the distribution, the collection, and duration.

XV. The society has a right to demand from every public agent an account of his administration.

XVI. Every society, in which the guarantee of rights is not assured, nor the separation of powers determined, has *no constitution.*

XVII. Property being a right inviolable and sacred, no person can be deprived of it, except when the public necessity, legally ascertained, shall evidently require it, and on condition of a just and previous indemnification.

The constitution guarantees, as natural and civil rights,

1. That all citizens are admissible to places and employments without any distinction, but that of ability and virtue.

2. That all contributions shall be divided equally among all the citizens, in proportion to their means.

3. That the same crimes shall be subject to the same punishments, without any distinction of persons.

The constitution in like manner guarantees, as natural and civil rights,

Liberty to all men of going, staying, or departing, without being arrested, or detained, but according to the forms prescribed by the constitution.

Liberty to all men of speaking, writing, printing, and "publishing their thoughts, without having their writings subjected to any examination or inspection before publication;" and of exercising the religious worship to which they are attached.

Liberty to all citizens of assembling peaceably, and without arms, complying with the laws of police.

Liberty of addressing to all constitutional authorities petitions individually signed.

The constitution guarantees the inviolability of property, or a just and previous indemnity for that of which public necessity, legally proved, shall require the sacrifice.

A public instruction shall be created and organized, common to all citizens, gratuitous with regard to those parts of tuition indispensable for all men, and of which the establishment shall be gradually distributed in a proportion combined with the division of the kingdom.

"The kingdom is one and indivisible;" its territory for administration, is distributed into 83 departments, each department into districts, each district into cantons.

Those are French citizens,

Who are born in France, of a French father.

Who having been born in France of a foreign father, have fixed their residence in the kingdom.

Who having been born in a foreign country, of a French father, have returned to settle in France, and have taken the civic oath:

In fine, who having been born in a foreign country, being descended in whatever degree from a Frenchman or Frenchwoman, who have left their country from religious motives, come to reside in France, and take the civic oath.

The right of French citizenship is lost,

1st, By naturalization in a foreign country;

2dly, By being condemned to penalties which involve the civic degradation, provided the person condemned be not reinstated;

3dly, By a sentence of contumacy, provided the sentence be not annulled;

4thly, By initiation into any foreign order or body which supposes either proofs of nobility "or distinctions of birth, or requires religious vows."

"The law considers marriage only as a civil contract."

The sovereignty is one, indivisible, "inalienable, and imprescriptible," and it belongs to the nation: no section of the people, or individual, can arrogate the exercise of it.

The nation, from which alone flow all powers, cannot exercise them but by delegation.

The French constitution is representative: the representatives are the legislative body and the king.

The National Assembly, forming the legislative body, is permanent, and consists of one chamber only.

It shall be formed by new elections every two years.

The legislative body cannot be dissolved by the king.

The number of representatives to the legislative body shall be 745, on account of the 83 departments of which the kingdom is composed; and independent of those that may be granted to the colonies.

The representatives shall be distributed among the departmen s, according to the three proportions of land, of population, and of the contribution direct.

Of the 745 representatives 247 are attached to the land. Of these each department shall nominate three, except the department of Paris, which shall nominate only one.

Two hundred and forty-nine representatives are attached to the population. The total mass of the active population of the kingdom is divided into 249 parts, and each department nominates as many of the deputies as it contains parts of the population.

Two hundred and forty-nine representatives are attached to the contribution direct. The sum total of the direct contribution of the kingdom is likewise divided into 249 parts; and each department nominates as many deputies as it pays parts of the contribution.

In

In order to form a legislative national assembly, the active citizens shall convene, in primary assemblies, every two years in the cities and cantons.

"The primary assemblies shall meet of full right on the first Sunday of March, if not convoked sooner by the public officers appointed to do so by the law."

To be an active citizen, it is necessary,

To be a Frenchman, or to have become a Frenchman;

To have attained 25 years complete;

To have resided in the city or the canton from the time determined by the law;

To pay in any part of the kingdom a direct contribution, at least equal to the value of three days labour, and to produce the acquittance;

Not to be in a menial capacity, namely, that of a servant receiving wages;

To be inscribed in the municipality of the place of his residence in the list of the national guards;

To have taken the civic oath.

The primary assemblies shall name electors in the proportion of the number of active citizens residing in the city or canton.

There shall be named one elector to the assembly, or not, according as there shall happen to be present 100 active citizens.

There shall be named two, when there shall be present from 151 to 250, and so on in this proportion.

The electors named in each department shall convene, in order to choose the number of representatives, whose nomination shall belong to their department, and a number of substitutes equal to the third of the representatives.

"The assemblies shall be held of full right on the last Sunday of March, if they have not been before convoked by the public officers appointed to do so by law."

All active citizens, whatever be their state, profession, or contribution, may be chosen representatives of the nation.

Excepting, nevertheless, the ministers and other agents of the executive power, &c.

The members of the legislative body may be re-elected to a subsequent legislature, but not till after an interval of one legislature.

No active citizen can enter or vote in an assembly if he is armed.

The representatives shall meet on the first Monday of May, in the place of the sittings of the last legislature.

The royalty is indivisible, and delegated hereditarily to the race on the throne from male to male, by order of primogeniture, to the perpetual exclusion of women and their descendants.

Nothing is prejudged on the effect of renunciations in the race on the throne.

The person of the king is inviolable and sacred; his only title is king of the French.

If the king put himself at the head of an army, and direct the forces of it against the nation, or if he do not oppose, by a formal act, any such enterprise undertaken in his name, he shall be held to have abdicated.

If the king having gone out of the kingdom, do not return to it, after an invitation by the legislative body, within the space which shall be fixed by the proclamation, "and which cannot be less than two months," he shall be held to have abdicated the royalty.

After abdication, express or legal, the king shall be in the class of citizens, and may be accused and tried like them, for acts posterior to his abdication.

The nation makes provision for the splendour of the throne by a civil list, of which the legislative body shall fix the sum at the commencement of each reign, for the whole duration of that reign.

The king is a minor till the age of 18 complete; and during his minority there shall be a regent of the kingdom.

The regency belongs to the relation of the king, next in degree according to the order of succession to the throne, who has attained the age of 25; provided he be a Frenchman resident in the kingdom, and not presumptive heir to any other crown, and having previously taken the civic oath.

The presumptive heir shall bear the name of *Prince Royal.*

"The members of the king's family called to the eventual succession of the throne, shall add the denomination of *French Prince* to the name which shall be given them in the civil act proving their birth; and this name can neither be patronymic nor formed of any of the qualifications abolished by the present constitution.

"The denomination of *prince* cannot be given to any individual, and shall not carry with it any privilege or exception to the common right of all French citizens."

To the king alone belong the choice and dismission of ministers.

"The members of the present national assembly, and of the subsequent legislatures, the members of the tribunal of appeal, and those who shall be of the high jury, cannot be advanced to the ministry, cannot receive any place, gift, pension, allowance, or commission of the executive power or its agents during the continuance of their functions, or during two years after ceasing to exercise them: the same shall be observed respecting those who shall only be inscribed on the list of high jurors as long as their inscription shall continue."

No order of the king can be executed if it be not signed by him, and countersigned by the minister or comptroller of the department.

In no case can the written or verbal order of a king shelter a minister from responsibility.

The constitution delegates exclusively to the legislative body the powers and functions following:

To propose and decree laws—The king can only invite the legislative body to take an object into consideration;

To fix the public expences;

To establish the public contributions, to determine the nature of them, the amount of each sort, the duration, and mode of collection, &c.

War cannot be resolved on but by a decree of the national assembly, passed on the formal and necessary proposition of the king, and sanctioned by him.

During the whole course of war, the legislative body may require the king to negotiate peace; and the king is bound to yield to this requisition.

It belongs to the legislative body to ratify treaties of peace,

peace, alliance, and commerce; and no treaty shall have effect but by this ratification.

The deliberations of the legislative body shall be public, and the minutes of the sittings shall be printed.

The legislative body may, however, on any occasion, form itself into a general committee.

The plan of a decree shall be read thrice, at three intervals, the shortest of which cannot be less than eight days.

The decrees of the legislative body are presented to the king, who may refuse them his consent.

In case of a refusal of the royal consent, that refusal is only suspensive.—When the two following legislatures shall successively present the same decree in the same terms on which it was originally conceived, the king shall be deemed to have given his sanction.

The king is bound to express his consent or refusal to each decree within two months after its presentation.

No decree to which the king has refused his consent can be again presented to him by the same legislature.

The supreme executive power resides exclusively in the hands of the king.

The king is the supreme head of the land and sea forces.

The king names ambassadors, and the other agents of political negotiations.

He bestows the command of armies and fleets, and the ranks of marshal of France and admiral:

He names two-thirds of the rear-admirals, one-half of the lieutenant generals, camp-marshals, captains of ships, and colonels of the national gendarmerie:

He names a third of the colonels and lieutenant-colonels, and a sixth of the lieutenants of ships:

He appoints in the civil administration of the marine, the directors, the comptrollers, the treasurers of the arsenals, the masters of the works, the under masters of civil buildings, half of the masters of administration, and the under masters of construction.

He appoints the commissaries of the tribunals:

He appoints the superintendants in chief of the management of contributions indirect, "and the administration of national domains:"

He superintends the coinage of money, and appoints officers entrusted with this superintendance in the general commission and the mints.

The effigy of the king is struck on all the coinage of the kingdom.

There is in each department a superior administration, and in each district a subordinate administration.

The administrators are specially charged with distributing the contributions direct, and with superintending the money arising from the contributions and the public revenues in their territory.

The king has the right of annulling such acts of the administrators of department as are contrary to the law or the orders transmitted to them.

He may, in case of obstinate disobedience, or of their endangering, by their acts, the safety or peace of the public, suspend them from their functions.

The king alone can interfere in foreign political connections.

Every declaration of war shall be made in these terms: *By the king of the French in the name of the nation.*

The judicial power can in no case be exercised either by the legislative body or the king.

Justice shall be gratuitously rendered by judges chosen from time to time by the people, and instituted by letters patent of the king, who cannot refuse them.

"The public accuser shall be nominated by the people."

"The right of citizens to determine disputes definitively by arbitration, cannot receive any infringement from the acts of the legislative power."

In criminal matters, no citizens can be judged except on an accusation received by jurors, or decreed by the legislative body in the case in which it belongs to it to prosecute the accusation.

After the accusation shall be admitted, the fact shall be examined, and declared by the jurors.

The person accused shall have the privilege of challenging 20, "without assigning any reason."

The jurors who declare the fact shall not be fewer than 12.

The application of the law shall be made by the judges.

The process shall be public; "and the person accused cannot be denied the aid of counsel."

No man acquitted by a legal jury can be apprehended or accused on account of the same fact.

For the whole kingdom there shall be one tribunal of appeal, established near the legislative body.

A high national court, composed of members of the tribunal of appeal and high jurors, shall take cognizance of the crimes of ministers, and the principal agents of the executive power; and of crimes which attack the general safety of the state, when the legislative body shall pass a decree of accusation.

It shall not assemble but on the proclamation of the legislative body; "and at the distance of 30,000 toises at least from the place of meeting of the legislative body."

The national guards do not form a military body, or an institution in the state; they are the citizens themselves called to assist the public force.

Officers are chosen for a time, and cannot again be chosen till after a certain interval of service as privates.

None shall command the national guard of more than one district.

All the parts of the public force employed for the safety of the state from foreign enemies are under the command of the king.

Public contributions shall be debated and fixed every year by the legislative body, and cannot continue in force longer than the last day of the following session, if they are not expressly renewed.

"Detailed accounts of the expence of the ministerial departments, signed and certified by the ministers or comptrollers-general, shall be printed and published at the commencement of the sessions of each legislature.

"The same shall be done with the statements of the receipt of the different taxes, and all the public revenues."

The French nation renounces the undertaking of any war with a view of making conquests, and will never employ its forces against the liberty of any people.

The constituting national assembly declares, "That the

the nation has the imprescriptible right of changing its constitution; and nevertheless considering that it is more conformable to the national interest to employ only by means provided in the constitution itself, the right of reforming those articles of it, of which experience shall have shown the inconveniences, decrees, that the proceeding by an assembly of revision shall be regulated in the form following:

"When three successive legislatures shall have expressed an uniform wish for the change of any constitutional article, the revision demanded shall take place.

"The next legislature, and the following, cannot propose the reform of any constitutional article.

"The fourth legislature, augmented with 249 members, chosen in each department, by doubling the ordinary number which it furnishes in proportion to its population, shall form the assembly of revision."

The French colonies and possessions in Asia, Africa, and America, "though they form part of the French empire," are not included in the present constitution.

With respect to the laws made by the national assembly which are not included in the act of constitution, and those anterior laws which it has not altered, they shall be observed, so long as they shall not be revoked or modified by the legislative power.

296 Is accepted by the king.

On the 13th of September the king announced, by a letter to the president of the assembly, his acceptance of the constitution. This event was ordered to be notified to all the foreign courts, and the assembly decreed a general amnesty with respect to the events of the revolution. On the following day the king repaired in person to the national assembly; and being conducted to a chair of state prepared for him at the side of the president, he signed the constitutional act, and took an oath of fidelity to it. He then withdrew, and was attended back to the Thuilleries by the whole

297 The assembly dissolved.

assembly, with the president at their head. On the 30th of September, this national assembly, which has since been known by the name of the *Constituent Assembly*, dissolved itself, and gave place to the succeeding *Legislative National Assembly*, which had been elected according to the rules prescribed by the new constitution.

298 Character and labours of the constituent assembly.

On the character and the labours of the *Constituent Assembly*, we shall only remark, that it contained many men of talents, and, in all probability, a considerable number of men of integrity. Towards the close of its session, it assumed a very striking character of moderation, and appears to have been completely monarchical, although its jealousy of the ancient aristocracy prevented it from sufficiently guarding the throne against popular violence: for a very striking defect in the new constitution soon appeared. The king possessed a *veto*, or negative, upon the resolutions of the legislative body: but this negative he was bound to exercise in *person*, without responsibility, and without the intervention of his ministers. He had no senate, or upper chamber, to stand between him and popular violence; and there was something apparently absurd in setting the vote of an individual in opposition to the collective wisdom and will of a whole nation. In consequence of this, he was reduced to the hard alternative of yielding to every vote of the national assembly, or of exposing himself personally to public odium.

The new assembly was opened by the king on the 7th of October, with much apparent union on all sides. His speech, recommending unanimity and confidence between the legislative and executive powers, was received with unbounded applause. The character of the men who composed the new national assembly was unauspicious to the Court. At the commencement of the revolution, the great body of the people at a distance from the capital were little interested in those projects of freedom which occupied the more enlightened or more turbulent inhabitants of Paris. They had gradually, however, been roused from their lethargy. The variety of powers conferred by the new constitution upon the people at large, and the multiplicity of offices of which it gave them the patronage, had kindled in the minds of men a love of dominion, and a wish to interfere in public affairs. This attached them to the new order of things. The love of power, which is the least disguised passion in the human heart, and equally strong in the breast of the meanest and of the highest of mankind, was thus, under the name of liberty, become a leading passion throughout this wide empire. They who flattered it most, and were most loud in praise of the rights of the people, became speedily the favourites of the public. The consequence of this was, that the new national assembly was chiefly composed of country gentlemen, of principles highly democratic, or of men of letters who had published popular books, or conducted periodical publications. The members of the constituent assembly had been excluded by their own decree from holding seats in the new legislature.—The members of the latter, therefore, had little regard for a constitution which they themselves had not framed, and which was not protected by the venerable sanction of antiquity.

299 The new assembly opened by the king. Character of the members.

When this assembly first met, it showed a very trifling attention to formalities, and a peevish jealousy of the ministers of the crown. In the mean time, the treaty of Pilnitz, already mentioned, began to be rumoured abroad, and France was thrown into a state of anxious jealousy for the safety of its newly-acquired liberties. Although the Prussians and Germans (the elector of Mentz alone excepted) all continued to temporize, the northern powers, Sweden and Russia, entered into strict engagements to restore the old despotism of France. On the 9th of November, a decree was passed, that the emigrants, who, after the first of January next, should be found assembled, as at present, in a hostile manner, beyond the frontiers, should be considered as guilty of a conspiracy, and suffer death; that the French princes, and public functionaries, who should not return before that period, should be punishable in the same manner, and their property forfeited during their own lives. On the 10th, a series of severe decrees was also passed against such of the ejected clergy as still refused to take the civic oath. To both these decrees the king opposed his *veto*, or negative.—The moderate party, who were attached to the constitution, rejoiced at this as a proof of the freedom of their sovereign. But, on the other side, it excited a most violent clamour, and became the means of exciting new suspicions of the wishes of the court. At this time answers were received from the different foreign courts to the notification sent them of the king's acceptance of the new constitution. These were generally conceived in a stile of caution, and avoided giving

300 Their jealousy of the ministers of the crown.

301 Pacific answers are received from foreign powers.

open

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open offence. The emperor even prohibited all assemblages of emigrants within his states; and the king intimated to the assembly that he had declared to the elector of Treves, that unless the emigrants should cease before the 15th of January to make hostile preparations within his territories, he would be considered as the enemy of France. All this, however, did not preserve the court from suspicion; for although the different foreign courts had openly declared pacific intentions, yet the French emigrants boldly asserted that all Europe was actually arming in their favour. Accordingly they ceased not to solicit their equals in rank, who still remained within the country, to leave it to join with them in what they called the *royal cause.*—The unhappy Louis, placed between a republican party that was gradually gathering strength, and an aristocratical party that was rousing Europe to arms against a nation of which he was the constitutional chief, and a combination of princes justly suspected of wishing to seize upon a part of his dominions, stood in a situation which would have perplexed the most skilful statesman; and it is no proof of incapacity that he fell a sacrifice to circumstances which might have overwhelmed any known measure of human ingenuity. Addresses were crowding into the assembly, disapproving the conduct of the court. M. Montmorin resigned; M. Delessart succeeded him; and M. Cahier de Gerville became minister of the interior. M. du Portail resigned also, and M. Narbonne succeeded him as minister of war. In the month of November, M. Bailly's mayoralty terminated; and the once popular La Fayette appeared as a candidate to succeed him. But he was successfully opposed by M. Petion, a violent Jacobin, and a declared republican, who was elected mayor of Paris by a great majority.

302 But the court is still suspected.

303 The ministry changed.

304 The Feuillans established to oppose the Jacobin club.

At this period the moderate men, who were friends of the constitution, attempted to counteract the influence of the Jacobin club by the establishment of a similar one. It derived its name from the vacant convent of the *Feuillans*, in which it assembled. The most active members of the Constitutent Assembly belonged to it, such as M. M. D'Andre, Barnave, the Lameths, Du Port, Rabaud, Sieyes, Chapelier, Thouret, Labord, Taleyrand, Montesquieu, Beaumetz, &c. The Jacobins contrived to excite a riot at the place of their meeting, which was in the vicinity of the hall of the National Assembly. This afforded a pretext for applying to the assembly for the removal of the new club. The assembly showed their disposition, by complying with this request.

305 State of France in the end of 1791 and beginning of 1792.

At the end of this year, the kingdom of France was by no means prosperous. The public revenue had fallen far short of the expenditure. The emigrant nobility had carried out of the kingdom the greater part of the current coin; and a variety of manufacturers, who depended upon their ostentatious luxury, were reduced to much distress. The dispositions of foreign courts appeared very doubtful. The new year, however, opened with delusive prospects of tranquillity.—The German princes appeared satisfied with the mode of compensation which the French had offered for the loss of their possessions in Alsace and Lorraine. The prince of Lowestein accepted of an indemnification.—The princes of Hohenlohé and Salm-Salm declared themselves ready to treat upon the same terms. Prince Maximilian, and the dukes of Wirtemberg and Deux-Ponts, freely negotiated. It is unnecessary to state in detail the subterfuges employed, in the mean time, by the crafty Leopold, for amusing the French with the appearances of peace. M. Delessart, minister for foreign affairs, fell a sacrifice to them, and probably to the undecided character of Louis. He was accused by M. Brissot of not having given timely notice to the National Assembly of the dispositions of foreign powers, and of not pressing proper measures for securing the honour and safety of the nation. A decree of accusation passed against him in his absence. He was apprehended, tried by the high national court at Orleans, and executed in consequence of its sentence.

306 The death of the emperor and murder of the king of Sweden.

The sudden death of Leopold on the first of March gave rise to a transient hope that peace might still be preserved. A suspicion of poison fell upon the French, but it was removed by the detail of his disease that was speedily published. On the 16th of the same month, the king of Sweden was wounded by a nobleman of the name of Ankerstrom, and died on the 29th. This enterprising prince had overturned the constitution of his own country, and he had formed the project of conducting in person his troops to the frontiers of France, and of commanding or accompanying the combined armies of Europe in their attempt to avenge the cause of insulted royalty. It was in a great measure to counteract this scheme that he was assassinated.

307 The emperor's successor openly avows warlike intentions.

The sudden fall, however, of these two enemies rather accelerated than retarded the meditated hostilities. The young king of Hungary, who succeeded to the empire, made no secret either of his own intentions or of the existence of a *concert of Princes* against France. M. Dumourier was now at the head of the war-office, M. Roland was minister of the interior, and M. Claviere minister of finance. The Jacobins were all-powerful. The court gave way to the torrent. The property of the emigrants was confiscated, reserving the rights of creditors. The Imperial minister, Prince Kaunitz, demanded three things of France; 1st, The restitution of their feudal rights to the German princes; 2dly, To restore Avignon to the Pope, the inhabitants of which had some time before thrown off their allegiance, and prevailed with the constituent assembly to receive their country as a part of France; and lastly, Prince Kaunitz demanded, that "the neighbouring powers should have no reason for apprehension from the present weakness of the internal government of France." On receiving these demands, the king proposed a declaration of war, which was decreed by the National Assembly on the 20th of April, against *the king of Hungary and Bohemia.*

308 And the Austrian Netherlands are unsuccessfully attacked by the French.

The French immediately began the war, by attacking in three different columns the Austrian Netherlands. M. Theobald Dillon advanced from Lisle to Tournay, where he found a strong body of Austrians ready to receive him. The national troops, unaccustomed to sustain the fire of regular soldiers, were instantly thrown into confusion, and fled even to the gates of Lisle. The cry of *treason* resounded on all sides; and their commander, an experienced and faithful officer, was murdered by his own soldiers and the mob. A second division of 10,000 men, under Lieutenant-General Biron, took possession of Quiverain on the 29th, and marched towards Mons. General Biron was here attacked by the

the Austrians, whom he repulsed. Hearing, however, of the defeat of Dillon, he retreated. A third party advanced to Furnes, but afterwards withdrew. La Fayette at the same time advanced towards Bouvines, half way to Namur, from which he afterwards retreated. The whole of these expeditions were ill contrived, in as much as they divided the French undisciplined troops, and exposed them in small bodies to the attack of veteran forces. The Austrians were some time before they attempted to retaliate. At length, however, on the 11th of June, they attacked M. Gouvion, who commanded the advanced guard of La Fayette's army near Maubeuge. M. Gouvion was killed by a rolling bullet; but La Fayette himself having come up, the Austrians abandoned the field.

309 The parties in Paris this period, and the consequences.

In the mean time, matters were hastening in Paris towards a violent crisis. Two parties, both of which were hostile to the present constitution, had gradually been formed in the state. The one wished to give more effectual support to the royal authority, by establishsng a *senate* or *two chambers*, to prevent the king's vote from being the sole check upon popular enthusiasm. The other party wished to set aside royalty altogether, and to hazard the bold experiment of converting France into a republic. These last were supported by the Jacobin club, which had now contrived to concentrate in itself an immense mass of influence. Innumerable popular societies were established in every town and village throughout the provinces. With these a regular correspondence was kept up by writing and by emissaries. Thus schemes and notions were instantaneously propagated through a great empire, and all the violent spirits which it contained were enabled to act in concert: But the more immediate engine of the republican party consisted of the immense population of the metropolis, whom they now endeavoured to keep in constant alarm. For this purpose they alleged, that an *Austrian Committee*, that is to say, a conspiracy in favour of the enemies of the country, existed among the friends of the court. M. M. Gensonne and Brissot even offered in the assembly to prove the existence of this pretended Austrian committee. A report was next circulated, that the king intended to abscond from the capital on the 23d of May. His majesty publicly contradicted these accusations as calumnies, but they made no small impression upon the minds of the public. New decrees were now made against the refractory clergy, but these his majesty refused to sanction. A proposal was also made and decreed in the assembly to form a camp of 20,000 men under the walls of Paris, and that for this levy every canton in the kingdom should contribute one horseman and four infantry. The national guard of Paris disliked the proposal, and the king gave to it his negative. Indeed at this time the king seems to have come to a resolution of standing out against the Jacobin party, to which he had for some time yielded. The ministry were therefore dismissed, excepting M. Dumourier, and others were appointed in their stead. By this event Dumourier lost the confidence of the Jacobin club. He saw his error, resigned his office, and joined the army. In the mean time a decree had been passed, authorising the manufactory of pikes for the purpose of arming cheaply the lower class of citizens. All means were used to render the king odious by inflammatory writings and harangues; and in both of these the noted incendiary Marat took the lead.

310 An armed mob marches through the assembly, &c.

On the 20th of Jnne, M. Roederer, the procureur general syndic informed the national assembly, that, contrary to law, formidable bodies of armed men were preparing to present petitions to the king, and to the national assembly. A part of them speedily appeared with St Huruge and Santerre a brewer at their head. They marched through the hall in a procession that lasted two hours, at four o'clock in the afternoon, to the number of about 40,000. They surrounded the Thuilleries. The gates were thrown open; and on an attempt to break the door of the apartment where the king then was, he ordered them to be admitted. His sister the princess Elizabeth never departed from his side during four or five hours that he was surrounded by the multitude, and compelled to listen to every indignity. All this while Petion, the mayor of Paris, was unaccountably absent. He at length, however, arrived, and also a deputation from the assembly. The queen, with her children and the princess de Lamballe, were in the mean time in the council-chamber, where, though protected from violence, they were yet exposed to much insult. At last, in consequence of the approach of evening, and of the entreaties of Petion, the multitude gradually dispersed.

311 The more respectable inhabitants are ashamed of such conduct.

The indignities suffered on this day by the royal family were in some respects not unfavourable to their cause. A great nnmber of the most respectable inhabitants of the capital were ashamed of such proceedings. They complained of them severely in a petition to the assembly, and addresses to the same purpose were received from several departments. The directory of the department of Paris, at the head of which were M. Rochefoucault and M. Talleyrand, published a declaration disapproving of the conduct of the mayor, and of M. Manuel the procureur of the commune, whom they afterwards suspended from their offices, although they were speedily restored by a decree of the assembly. At the same time, La Fayette leaving his army suddenly, appeared on the 26th at the bar of the national assembly. He declared that he came to express the indignation which the whole army felt on account of the events of the 20th: he called upon the assembly to punish the promoters of these events, and to dissolve the factious clubs. The sudden appearance of La Fayette threw the Jacobins into consternation, and from that period they never ceased to calumniate him.

312 The king of Prussia marches against France.

On the 1st of July, on the motion of M. Jean de Brie, the assembly ordered a proclamation to be made, that *the country was in danger*. On the 6th, the king gave intimation that the king of Prussia was marching with 52,000 men to co-operate against France. The French arms were at this time somewhat successful in the Austrian Netherlands; but the cabinet speedily thought it necessary to order the armies to retreat: a measure which was afterwards publicly censured by Marshal Luckner.

313 Moderate speech of the bishop of Lyons.

On the 7th, a singular scene occurred in the national assembly. At the instant that M. Brissot was about to commence an oration, M. Lammourette bishop of Lyons requested to be heard for a few minutes. He expatiated on the necessity of union among the members of the assembly, and of sacrificing their passions and prejudices

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judices on the altar of their country. He concluded an animated address with these words, "Let all who hold in equal detestation a republic and two chambers, and who wish to maintain the constitution as it is, rise!" The words were scarcely pronounced when the whole assembly started from their seats. Men of all parties solemnly embraced each other, and protested their adherence to the constitution. A deputation announced this happy event to the king; who immediately came and congratulated them in a short speech, which was received with infinite applause. The only good effect, however, produced by this temporary agreement was, that the festival of the 14th of July, which was celebrated with the usual magnificence, passed over in tranquillity.

314 Manifesto of the duke of Brunswick.

On the 25th of July, the duke of Brunswick issued at Coblentz his celebrated manifesto. It declared the purpose of the intended invasion of France to be the restoration of the French king to full authority. It declared the national guard of France responsible for the preservation of tranquillity; and threatened with the punishment of death, as rebels to their king, these who should appear in arms against the allied powers. All men holding offices, civil or military, were threatened in the same manner, as well as the inhabitants of all cities. The city of Paris in particular, and the national assembly, were declared responsible for every insult which might be offered to the royal family. It was declared, that if they were not immediately placed in safety, the allies were resolved to inflict "on those who should deserve it, the most exemplary and ever memorable avenging punishments, by giving up the city of Paris to military execution, and exposing it to total destruction; and the rebels who should be guilty of illegal resistance should suffer the punishments which they should have deserved."

315 Injurious to Louis.

This sanguinary and imprudent manifesto operated as a warrant for the destruction of the unfortunate Louis XVI. It left no middle party in the nation. All who wished to preserve freedom in any form, and all who loved the independence of their country, were instantly united. At the same time, the reproaches cast on the king by the Jacobins now gained universal credit. The kings of Prussia and of Hungary told the French nation, that their monarch was secretly hostile to the constitution; and the restoration of him and his family to despotic power was made the sole pretence for a bloody and dangerous war.

316 But advantageous to the republican party, who resolve to depose him.

The republican party saw the advantage which they had now gained, and resolved upon the deposition of the king. The chief engine which they meant to employ in this service consisted of about 1500 men, who had come to Paris at the period of the confederation on the 14th of July, and therefore called *fœderés*, and who were also sometimes denominated *Marseillois*, from the place from which the greater number of them came. Next to these, dependence was placed in the populace of the suburbs of the capital. The designs of the republicans were not unknown to the court, and both parties were forming plans of operation. It is said that the royal party intended that the king and his family should suddenly leave the capital, and proceed to as great a distance as the constitution permitted. The republicans are said to have intended to seize the person of the king, and to confine him in the castle of Vincennes till a national convention should decide upon his fate. Both allegations are probably true. Every motive which can influence the mind of man must have induced Louis to wish to be at a distance from the factious and sanguinary capital. And the subsequent conduct of the republicans authorize us to believe them capable of the worst crime that was laid to their charge.

317 La Fay[ette] accused and acquitted.

Various charges had been brought forward in the assembly against La Fayette, and the 8th of August was appointed for their discussion. In the mean time, on the 3d of August, Petion the mayor, at the head of a deputation from the section of Paris, appeared at the bar, and in a solemn speech demanded the deposition of the king. The discussion of the accusation against La Fayette was considered as a trial of strength between the parties: he was acquitted, however, by a majority of nearly 200; and the republican party, despairing of carrying their point by a vote of the national assembly, resolved to have recourse to insurrection and force.

31[8] Horrid [plot] of the [re]publica[ns].

On the evening of the 9th of August, about 1500 gentlemen, officers of the army, and others, repaired to the palace, resolved to protect the royal family or to die in their defence: added to these were 700 Swiss guards, with a body of cavalry amounting to about 1000. Mandat, the commander of the national guards, a man who was firmly attached to the constitution, had procured 2400 of that body and 12 pieces of cannon. With such a force, it has been generally thought that, by vigorous and steady councils, the palace, which is a kind of castle, might have been successfully defended; and what is now called a revolution might have borne the name of a rebellion. Meanwhile the assembly declared its sittings permanent. Petion was at the palace late on the evening of the 9th. Some apprehensions were entertained, or pretended to be entertained, for his safety (for the whole of this business was, on the part of the republicans, the most infernal plot), and a deputation from the assembly brought him away. At midnight the tocsin or alarm bell was sounded, and the drums beat to arms through the city. At this instant a number of the most active leaders of the republican party assembled, and elected a new common council or *commune*. The persons thus irregularly chosen instantly took possession of the common hall, and drove out the lawful members; who, with that weakness with which men are apt to shrink from stations of responsibility in perilous times, readily gave place to the usurpers. The new commune sent repeated messages to M. Mandat, requiring his attendance upon important business. He was occupied in arranging the troops in the best order around the palace; but suspecting nothing, he went to the common hall, and was there astonished to find a different assembly from what he expected. He was abruptly accused of a plot to massacre the people, and ordered to prison; but as he descended the stairs, he was shot with a pistol, and Santerre was appointed in his stead to command the national guard.

On this eventful night no person in the palace went to bed. About six o'clock in the morning of the 10th the king descended into the gardens to review the troops. He was received with shouts of *Vive le roi*, excepting from the artillery, who shouted *Vive le nation*. The king returned to the palace, and the multitude continued to collect. The national guard seemed undetermined about what they were to do, as they assembled in divisions near the palace; and had a steady resistance

sistance been made from within, it is probable they would have joined the royal party. But towards eight o'clock M. Roederer procured admittance to the palace, and told the king that armed multitudes were assembling in hostile array around the Thuilleries; that the national guard was not to be depended upon; and that, in case of resistance, the whole royal family would most certainly be massacred. He therefore advised the king to seek protection in the hall of the national assembly. With this advice the king, with his usual facility of temper, was ready to comply; but the queen opposed with vehemence the humiliating proposal. Becoming gradually, however, alarmed for the safety of her children, she gave her consent; and the king and queen, the princess Elizabeth, with the prince and princess royal, went on foot to the hall of the assembly. "I am come hither (said his majesty) to prevent a great crime. Among you, gentlemen, I believe myself in safety." By an article of the constitution the assembly could not deliberate in presence of the king. The royal family were, therefore, placed in a narrow box separated from the hall by a railing, where they remained for 14 hours without any place to which they could retire for refreshment, excepting a very small closet adjoining. Here they sat listening to debates, in which the royal character and office were treated with every mark of insult.

When the king left the palace of the Thuilleries, he unfortunately forgot to order it to be immediately surrendered. He recollected this as soon as he reached the assembly, and sent orders for this purpose; but it was now too late. The insurgents amounted to about 20,000 effective men. They were drawn up in tolerable order by Westerman a Prussian, and had about 30 pieces of cannon along with them. The gentlemen within the palace, who had assembled to protect the king's person, were now dispirited, and knew not what part to act. The commander of the Swiss, M. Affry, was absent, and the captains knew not what to do; and the national guard had no leader in consequence of the death of Mandat. About nine o'clock the outer gates were forced open; and the insurgents formed their line in front of the palace. A bloody combat commenced chiefly between the Marseillois and the Swiss. After a brave resistance of about an hour, the Swiss were overpowered by numbers, and gave way. All of them that could be found in the palace were massacred; some even while imploring quarter on their knees. Others escaped into the city, and were protected by individuals. Of this brave regiment, however, only 200 survived; but every human being, even the lowest servants found in the palace, were put to death. The Swiss taken prisoners in various quarters were conducted to the door of the assembly, and taken by a decree under the protection of the state. But the sanguinary multitude insisted upon putting them to instant death; and the assembly would, in all probability, have been unable to protect them, had not the Marseillois interfered in their favour.

The suspension of the royal authority was now decreed, and the nation was invited to elect a *Convention* to determine the nature of its future government. On this uncommon occasion all Frenchmen of 21 years of age were declared capable of electing, and of being elected, deputies to the new national convention. Commissioners, were, in the mean time, sent on the same evening to give to the armies a false and favourable account of these transactions. The royal family were sent to the old palace of the Temple in the midst of the city, to remain there under a strict guard; and all persons of rank who had been attached to them were seized and committed to the different prisons.

322 Bloody temper of the people of Paris, &c.

To give an idea of the temper of the people of Paris at this time, it is proper to remark, that at the same instant when the multitude with a bloody fury was massacring the menial servants in the palace, and could scarcely be restrained from offering violence to the Swiss who were made prisoners, they would suffer no act of pillage to pass unpunished. Several attempts of this kind were accordingly followed by the instant death of the criminals. The plate, the jewels, and money found in the Thuilleries were brought to the national assembly, and thrown down in the hall. One man, whose dress and appearance bespoke extreme poverty, cast upon the table an hat full of gold. But the minds of these men were elevated by enthusiasm; and they conceived themselves at this moment the champions of freedom, and objects of terror to the kings of the earth.

323 Critical situation of the whole kingdom.

In the mean time, the situation of France was extremely critical, and it appeared very doubtful if the new convention would ever be suffered to assemble. La Fayette had accidentally got speedy notice of the events of the 10th of August. He advised the magistrates of the town of Sedan to imprison the commissioners from the national assembly when they should arrive there; which was accordingly done. He, at the same time, published an address to his army, calling upon them to support the king and the constitution; but finding that they were not to be depended upon, on the 19th of August he left the camp in the night, accompanied only by his staff and a few servants. They took the route of Rochefort in Liege, which was a neutral country; but were met by a party of the enemy, who took them prisoners, and La Fayette was detained for several years in Prussian and Austrian dungeons. The severe treatment of this man was probably a considerable error in policy on the part of the allies. His fidelity to his king is very generally admitted; though some have entertained strong suspicions of his having acted a very base part to that unfortunate monarch; and in the British house of commons he has been called an abandoned ruffian. The expression is certainly too strong. His errors seem to have been those of the head rather than of the heart; and at all events, he should have been protected by the allies, if for no other reason than to encourage subsequent desertions among the officers of the republican army.

324 La Fayette withdraws from the army.—His fate and character.

To return from this digression. The commissioners were soon set at liberty at Sedan, and received with applause by the army of La Fayette. General Arthur Dillon at first entered into the sentiments of La Fayette; but the politic Dumourier diverted him from his purpose, and by this means regained his credit with the Jacobins, and was appointed commander in chief. The other generals, Biron, Montesquieu, Kellerman, and Custine, made no opposition to the will of the national assembly.

Meanwhile, the combined armies of Austria and Prussia had entered France. The duke of Brunswick's army

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325 The combined armies enter France in great force.

army was above 50,000 strong. General Clairfait had joined him with 15,000 Austrians, and a considerable body of Hessians, along with 20,000 French emigrants; amounting in all to 90,000 men. To oppose these, Dumourier had only 17,000 men collected near the point from which the enemy were approaching in Luxembourg. The French emigrants had given the duke of Brunswick such an account of the distracted state of their own country, and of the pretended disaffection of all orders of men towards the ruling faction in Paris, that no resistance of any importance was expected. When the combined troops, consisting either of steady Austrian or Hungarian battalions, or of those well disciplined Prussians which the great Frederick had inured to the best military discipline, were reviewed in Germany before setting out on their march, it is said that the spectators, among whom the French cause was not unpopular, beheld them with anxiety and regret, and pitied the unhappy country against which this irresistible force was directed. The soldiers and their officers regarded themselves as departing for a hunting match, or an excursion of pleasure; and many of the usual accommodations of an army were ill attended to, such as hospitals, &c. The beginning of their progress into France justified these expectations. Longwy surrendered after a siege of 15 hours, although well fortified, possessed of a garrison of 3500 men, and defended by 71 pieces of cannon. The news of this event irritated the assembly so much, that they decreed, that, when retaken, the houses of the citizens should be razed to the ground; and, distrustful of the officers of the army, they decreed that the municipal officers of a town should hereafter have power to controul the deliberation of the council of war. Verdun was next summoned; and here the municipality compelled the governor M. Beaurepaire to surrender. That officer, disappointed and enraged, shot himself dead with a pistol in presence of the council, and on the 2d of September the Prussian troops entered the town.

326 Alarm at Paris on account of their success.

The news of this second capture, and of the approach of the Prussians, spread an instant alarm through Paris. It was proposed to raise a volunteer army, which should set out immediately to meet the enemy. The common council, which was now led by Robespierre, Danton, Marat, and others of the most sanguinary character, ordered the alarm-guns to be fired, and the populace to be summoned to meet in the Champ de Mars to enroll themselves to march against the enemy. The people assembled, and either in consequence of a premeditated plan, or, which is not very probable, of an instantaneous movement, a number of voices exclaimed, that "the domestic foes of the nation ought to be destroyed before its foreign enemies were attacked."

327 Horrid massacres.

Parties of armed men proceeded without delay to the prisons where the non-juring clergy, the Swiss officers, and those confined since the 10th of August on account of practices against the state, were detained in custody. They took out the prisoners one by one, gave them a kind of mock trial before a jury of themselves, acquitted some few, and murdered the rest. Among these last was the princess de Lamballe. She was taken from her bed before this bloody tribunal, and massacred; her head was carried by the populace to the Temple, to be seen by the queen, whose friend she was. These massacres lasted for two days, and upwards of 1000 persons were put to death. There is scarce any thing in history that can be represented parallel to them; they were committed, it is said, by less than 300 men, in the midst of an immense city, which heard of them with horror, and in the vicinity of the national assembly, which, by going in a body, could have put an end to them. But such was the confusion and dismay of these two disgraceful days, that no man dared to stir from his own house; and every one believed that the whole city, excepting his own street, was engaged in massacre and bloodshed. The national guard were all ready at their respective posts, but no man directed them to act: and there is too much reason to suspect that Santerre and the chiefs of the commune connived, at least, at the transaction.

32[8] State o[f] the Fr[ench] army, [as] conduc[ted by] Dumou[rier].

In the mean time, General Dumourier was taking the best measures to protract the march of the enemy till the army of Kellerman, consisting of 20,000 men, could join him from Lorraine, and that of Bournonville from Flanders, amounting to 13,000; together with whatever new levies Luckner might be able to send him from Chalons. The forest of Argonne extends from north to south upwards of 40 miles; it lay directly in the route of the duke of Brunswick, who must either force his way across it, or make a circuit of 40 miles by the pass of Grandpre on the north, or by Barleduc on the south. The pass that lay directly in his route was that of Biesme. After surveying Dillon's position here, he left a party of 20,000 men to watch it; and with the main body of his army took the circuitous route by Grandpre on the north. Here Dumourier waited to receive him, and was attacked on the 12th and 13th without success: but on the 14th, the attack of the Prussians was irresistible, and Dumourier retreating, gave up the pass. On his march he was so violently pressed by the advanced cavalry of the Prussians, that his army, at one time, was seized with a panic, and fled before 1500 men; who, if they had pushed their advantage, might have dispersed it. On the 15th, however, Dumourier encamped at St Menehould, and began to fortify it. Bournonville's army joined Dumourier on the 17th. The duke of Brunswick formed a plan of attacking Kellerman before his junction could be completed. That general arrived on the 19th within a mile of Dumourier's camp; the projected attack took place; the Prussians manœuvred with their usual coolness and address; they attempted to surround Kellerman's army, but this could not be accomplished. The French troops preserved excellent order, while the national vivacity was constantly showing itself in their shouts and patriotic songs: 400 French were killed, and 500 wounded; the loss of the Prussians was much greater: and, in the face of the enemy, Kellerman joined Dumourier at the end of the engagement without opposition. At the time that the attack was made on the army of Kellerman, an attempt was made to force Dillon's camp at Biesme by the 20,000 men that had been left in its vicinity, but without success; and this large detachment was thus prevented from crossing the forest of Argonne and joining the duke of Brunswick. It is to be observed, that in these engagements the French owed their superiority chiefly to the excellence of their artillery; a circumstance which served to convince their enemies that they had

32[9] The Pr[us]sians ob[lige] him to [re]treat, b[ut] do not [fol]low up their a[d]vantag[e].

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332 The Prussians distressed by sickness and famine.

had to contend with regular military bodies, and not with undisciplined multitudes, as they expected.

The duke of Brunswick encamped his army at La Lun, near the camp of Dumourier. And here the Prussians began to be in extreme distress both from sickness and famine. No temptation could induce the inhabitants of the country to carry provisions to the hostile camp, while at the same time the French army was abundantly supplied.

Bournonville, with a body of 4000 men, intercepted several droves of cattle and other convoys of provisions destined for the Prussians. The rain fell in torrents, and the roads were uncommonly deep. Exposed to the cold, the moisture, and want of provisions, the Prussians rashly ate great quantities of the grapes of Champagne. The consequence of this was, that an epidemical distemper commenced and spread through the army to such an extent, that 10,000 men at one time were unfit for duty. The duke of Brunswick, however, still commanded a force much more numerous than that of Dumourier; and he has been much censured for not attacking his camp, and forcing him to engage. It has been said that the veteran and numerous force which he commanded would have marched to certain victory against the raw troops that opposed them; that, having defeated Dumourier's army, there was nothing to oppose their march to Paris. But the duke of Brunswick had entered France upon the supposition, that in its present distracted state no regular army could be brought into the field against him, and that the people at large were hostile to the ruling faction. The contrary of all this had turned out to be true. He found himself in the midst of an hostile people, and opposed by skilful military chiefs. A defeat in such a situation would have brought certain ruin to his army; and even the loss sustained in the acquisition of a victory might have proved equally fatal. The remains of the French army would not fail to hang upon his rear; and from the disposition of the people it appeared impossible to ascertain to what amount that army might be suddenly increased. After proposing a truce, therefore, which lasted eight days, he commenced his retreat towards Grandpré, and no advantage was gained over him in the course of it. Verdun was retaken by the French on the 12th of October, and Longwy on the 18th; the siege of Thionville was at the same time raised. That small, but strong fortress, under the command of General Felix Wimpfen, had held in check an army of 15,000 men.

333 Lisle summoned and vigorously besieged by the Austrians, but in vain.

While the Prussians were advancing from the north-east, the Austrians under the duke of Saxe Teschen laid siege to Lisle. The council-general of the commune answered the summons of the besiegers thus: "We have just renewed our oath to be faithful to the nation, and to maintain liberty and equality, or to die at our post. We will not perjure ourselves." Such was the cant of these men, who had already perjured themselves by contributing to overturn the constitution which they had repeatedly sworn to defend. The Austrian batteries began to play upon the town on the 29th, and were chiefly directed against that quarter which was inhabited by the lower class of citizens, for the purpose of making them mutinous and seditious. This procedure was ill judged. The lower classes of mankind are always much accustomed to hardships, and they go farthest in support of any enthusiastic principle they have been persuaded to adopt. Accordingly, though a great part of the city was reduced to a heap of ruins, the citizens of Lisle became daily more obstinate. They received each other into the houses that were still standing, and every vault and cellar was occupied. Although upwards of 30,000 red-hot balls and 6000 bombs were thrown into the city, besides the efforts made by an immense battering train of artillery, yet the loss both to the garrison and people did not exceed 500 persons, most of whom were women and children. After a fortnight of fruitless labour, the Austrians raised the siege.

334 War declared against the king of Sardinia, Savoy taken, &c.

War had been declared against the king of Sardinia on account of the threatening appearances exhibited in that quarter. On the 20th of September General Montesquieu entered the territories of Savoy, and was received at Chambery and throughout the whole country with marks of unbounded welcome. On the 29th General Anselm, with another body of troops, took possession of Nice and the country around it. On the 30th General Custine advanced to Spires, when he found the Austrians drawn up in order of battle. He attacked and drove them through the city, taking 3000 of them prisoners. The capture of Worms succeeded that of Spires; Mentz surrendered by capitulation; and Francfort fell into the hands of the French on the 23d. Out of this last place, however, they were afterwards driven on the 2d of December.

335 The national convention assembled,

On the 20th of September the French *National Convention* assembled. It was found to contain men of all characters, orders, and ranks. Many distinguished members of the *Constituting* Assembly were elected into it, and also several that had belonged to the *Legislative* Assembly; even foreigners were invited to become French legislators. The famous Thomas Paine and Dr Priestley of England were elected by certain departments; but the latter declined accepting. Clouts, a Prussian, whom we formerly noticed as bringing a deputation to the bar of the constituent assembly, consisting of persons representing all the nations of the earth, was also chosen. The general aspect of the new convention showed that the republican party had acquired a decided superiority. On the first day of meeting M. Collot d'Herbois, who had formerly been an actor, ascended the tribune, and proposed *the eternal abolition of royalty in France*. The question was carried by acclamation, and the house adjourned. Messages were sent to all parts of the country to intimate the decree, and by the influence of the Jacobins they were everywhere received with applause. It was next day decreed, that all public acts should be dated by the year of the French republic; and all citizens were declared eligible to all the vacant offices and places. The rage of republicanism soon went so far, that the ordinary titles of Monsieur and Madame were abolished, and the appellation of *Citizen* substituted in their stead, as more suitable to the principles of liberty and equality.— It may be remarked, that in this last trifling circumstance an attachment to the form of speech to which they had been accustomed appears even in its abolition: For, although the Roman orators addressed their countrymen when assembled by the honourable appellation of *Citizens*, yet they never, in accosting an individual, called him Citizen Cato, or Citizen Cæsar, according to the mode now adopted in France.

336 and decrees the eternal abolition of royalty in France.

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357 Two opposite factions in the convention.

It was soon discovered that the leading republicans had divided into two opposite factions. The one of these was called *Girondists*, because Vergniaud, Gensonné, Gaudet, and some others of its leaders, were members from the department of La Gironde. The celebrated Condorcet belonged to this party; and they were sometimes denominated *Brissotines*, from M. Brissot de Warville their principal leader. They supported the ministry now in office, at the head of which was Roland; and the majority of the convention was obviously attached to them. In opposition to these was the smaller party of the *Mountain*: so called from its members usually sitting in the convention on the upper seats of the hall. They were men possessed of less personal respectability, and fewer literary accomplishments, but of daring and sanguinary characters, whom the revolution had brought into public notice. At the head of this party were Danton and Robespierre; and subordinate to these were Couthon, Bazire, Thuriot, Merlin de Thionville, St André, Camille Demoulins, Chabot, Collot D'Herbois, Sergent, Legendre, Fabre d'Eglantine, Panis, and Marat.

These two parties shewed the diversity of their characters in the manner in which they treated the massacres of the 2d and 3d of September. The Brissotines, with the majority of the convention, wished to bring the murderers to trial; but the question was always eluded by the other party, with the assistance of the Jacobin club and of the populace.

338 Decree against the emigrants, &c.

On the 9th of October it was decreed, that all emigrants, when taken, should suffer death; and on the 15th of November, in consequence of an insurrection in the duchy of Deux Ponts, and an application on the part of the insurgents to the convention for aid, the following decree was passed: "The national convention declare, in the name of the French nation, that they will grant fraternity and assistance to all those people who wish to procure liberty; and they charge the executive power to send orders to the generals to give assistance to such people as have suffered, or are now suffering, in the cause of liberty." Of this decree foreign nations, with great reason, complained much, as will shortly appear.

339 Battle of Jemappe, and surrender of the Austrian Netherlands.

To return to the military affairs of the new republic. On the 12th of October General Dumourier came to Paris, and was speedily sent to commence a winter campaign in the Netherlands. He suddenly attacked the Austrians at the village of Bossu, and drove them from their ground. On the 5th of November he came in sight of the enemy upon the heights of *Jemappe*. Three rows of fortifications arose above each other, defended by 100 pieces of cannon. Their right was covered by the village and a river, and their left by thick woods. The French were by their own account 30,000, whilst others, with great probability of truth, compute them at double that number, and the number of the Austrians was at least 20,000. At seven in the morning of the following day a heavy cannonade commenced on both sides, and at noon a close attack was determined on by the French, whose right wing was commanded by Generals Bournonville and Dampierre, and the centre by Generals Egalité (son to the duke of Orleans who had assumed that name), Stetenboffe, Desporets, and Drouet. The music played the popular march of the Marsellois, and the soldiers rushed on with enthusiasm, shouting "Vive la nation." The engagement was warm and bloody; the French were twice repulsed; but their impetuosity was at last irresistible, and about two o'clock the enemy fled from their last entrenchments. The loss on both sides was very great, that of the Austrians amounting to 4000. This victory was decisive of the fate of the Netherlands. Mons and Brussels surrendered to Dumourier; Tournay, Malines, Ghent, and Antwerp, were taken possession of by General Labourdonnaye; Louvaine and Namur were taken by General Valence; and the whole Austsian Netherlands, Luxembourg only excepted, fell into the hands of the French: Liege was taken on the 28th of November after a successful engagement, in which the Austrians lost 500 or 600 men and an immense train of artillery.

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340 Violent contests between the Girondists and the Mountain.

France was now in a situation not unusual in the history of those nations that either are free, or are attempting to become so; successful in all quarters abroad, but distracted by factions at home. The two parties in the convention were engaged in a struggle, which daily became more implacable. The party called the *Mountain* did not hesitate about the nature of the means they were to employ to bring about the ruin of their antagonists. They are even suspected of having, through the medium of Pache the war-minister, retarded the supply of the armies, to render the ruling party odious by want of success. They were for some time, however, unfortunate in this respect; and the daily news of victories supported with the public the credit of the Girondists. A new subject was therefore fallen upon, which was the question, how the dethroned king was to be disposed of? The moderate party wished to save him; and this was a sufficient reason for their antagonists to resolve upon his ruin. A committee was appointed to give in a report upon his conduct. A variety of accusations were brought against him; and the convention infamously resolved to act the part of accusers and of judges.

341 The king brought to trial.

It was on the 11th of December when the ill-fated monarch was ordered to the bar of the convention: the act of accusation was read, and the king was summoned by the president, Barrere, to answer to each separate charge.

Pres. "Louis, the French nation accuses you of having committed a multitude of crimes to establish your tyranny, in destroying her freedom. You, on the 20th of June 1789, attempted the sovereignty of the people, by suspending the assemblies of their representatives, and expelling them with violence from the places of their sittings. This is proved in the process verbal entered at the Tennis-court of Versailles by the members of the constituent assembly. On the 23d of June you wanted to dictate laws to the nation; you surrounded their representatives with troops; you presented to them two royal declarations, subversive of all liberty, and ordered them to separate. Your own declarations, and the minutes of the assembly, prove these attempts. What have you to answer?"

Louis. "No laws were then existing to prevent me from it."

Pres. "You ordered an army to march against the citizens of Paris. Your satellites have shed the blood of several of them, and you would not remove this army till the taking of the Bastile and a general insurrection announced to you that the people were victorious. The speeches

speeches you made on the 9th, 12th, and 14th of July to the deputations of the constituent assembly, shew what were your intentions; and the massacres of the Thuilleries rise in evidence against you.—What have you to answer?"

Louis. "I was master at that time to order the troops to march; but I never had an intention of shedding blood."

Pres. "After these events, and in spite of the promises which you made on the 15th in the constituent assembly, and on the 17th in the town-house of Paris, you have persisted in your projects against national liberty. You long eluded the execution of the decrees of the 11th of August, respecting the abolition of personal servitude, the feudal government, and tythes: you long refused acknowledging the rights of man: you doubled the number of the life-guards, and called the regiment of Flanders to Versailles: you permitted, in orgies held before your eyes, the national cockade to be trampled under foot, the white cockade to be hoisted, and the nation to be slandered. At last, you rendered necessary a fresh insurrection, occasioned the death of several citizens, and did not change your language till after your guards had been defeated, when you renewed your perfidious promises. The proofs of these facts are in your observations of the 18th of September, in the decrees of the 11th of August, in the minutes of the constituent assembly, in the events of Versailles of the 5th and 6th of October, and in the conversation, you had on the same day with a deputation of the constituent assembly, when you told them you would enlighten yourself with their councils, and never recede from them.—What have you to answer?"

Louis. "I have made the observations which I thought just on the two first heads. As to the cockade, it is false; it did not happen in my presence."

Pres. "You took an oath at the federation of the 14th of July, which you did not keep. You soon tried to corrupt the public opinion, with the assistance of Talon who acted in Paris, and Mirabeau who was to have excited counter-revolutionary movements in the provinces.—What have you to answer?"

Louis. "I do not know what happened at that time; but the whole is anterior to my acceptance of the constitution."

Pres. "You lavished millions of money to effect this corruption, and you would even use popularity as a means of enslaving the people. These facts are the result of a memorial of Talon, on which you have made your marginal comments in your own hand-writing, and of a letter which Laporte wrote to you on the 19th of April; in which, recapitulating a conversation he had with Rivarol, he told you, that the millions which you had been prevailed upon to throw away had been productive of nothing. For a long time you had meditated on a plan of escape. A memorial was delivered to you on the 28th of February, which pointed out the means for you to effect it; you approve of it by marginal notes.—What have you to answer?"

Louis. "I felt no greater pleasure than that of relieving the needy: this proves no design."

Pres. "On the 28th a great number of the nobles and military came into your apartments in the castle of the Thuilleries to favour that escape; you wanted to quit Paris on the 10th of April to go to St Cloud.—What have you to answer?"

Louis. "This accusation is absurd."

Pres. "But the resistance of the citizens made you sensible that their distrust was great; you endeavoured to discard it by communicating to the constituent assembly a letter, which you addressed to the agents of the nation near foreign powers, to announce to them that you had freely accepted the constitutional articles, which had been presented to you; and, notwithstanding, on the 21st you took flight with a false passport. You left behind a protest against these self-same constitutional articles; you ordered the ministers to sign none of the acts issued by the national assembly; and you forbade the minister of justice to deliver up the seals of state. The public money was lavished to insure the success of this treachery, and the public force was to protect it, under the orders of Bouillé, who shortly before had been charged with the massacre of Nancy, and to whom you wrote on this head, "to take care of his popularity, because it would be of service to you." These facts are proved by the memorial of the 23d of February, with marginal comments in your own hand-writing; by your declaration of the 20th of June, wholly in your own hand-writing; by your letter of the 4th of September 1790 to Bouillé; and by a note of the latter, in which he gives you an account of the use he made of 993,000 livres, given by you, and employed partly in trepanning the troops who were to escort you.—What have you to answer?"

Louis. "I have no knowledge whatever of the memorial of the 23d of February. As to what relates to my journey to Varennes, I appeal to my declaration to the commissaries of the constituent assembly at that period."

Pres. "After your detention at Varennes, the exercise of the executive power was for a moment suspended in your hands, and you again formed a conspiracy. On the 17th of July the blood of citizens was shed in the Champ de Mars. A letter, in your own hand-writing, written in 1790 to La Fayette, proves that a criminal coalition subsisted between you and La Fayette, to which Mirabeau acceded. The revision began under these cruel auspices; all kinds of corruptions were made use of. You have paid for libels, pamphlets, and news-papers, designed to corrupt the public opinion, to discredit the assignats, and to support the cause of the emigrants. The registers of Septeuil shew what immense sums have been made use of in these liberticide manœuvres.—What have you to answer?"

Louis. "What happened on the 17th of July has nothing at all to do with me. I know nothing of it."

Pres. "You seemed to accept the constitution on the 14th of September; your speeches announced an intention of supporting it, and you were busy in overturning it, even before it was completed. A convention was entered into at Pilnitz on the 24th of July, between Leopold of Austria and Frederic-William of Brandenburgh, who pledged themselves to re-erect in France the throne of absolute monarchy, and you were silent upon this convention till the moment when it was known by all Europe.—What have you to answer?"

Louis. "I made it known as soon as it came to my knowledge; besides, every thing that refers to this subject concerns the minister."

 Pres.

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Pres. "Arles had hoisted the standard of rebellion; you favoured it by sending three civil commissaries, who made it their business not to repress the counter-revolutionists, but to justify their proceedings.—What have you to answer?"

Louis. "The instructions which were given to the commissaries must prove what was their mission; and I knew none of them when the ministers proposed them to me."

Pres. "Avignon, and the county of Venaissin, had been united with France; you caused the decree to be executed; but a month after that time civil war desolated that country. The commissaries you sent thither helped to ravage it.—What have you to answer?"

Louis. "I do not remember what delay has been caused in the execution of the decree; besides, this occurrence has no personal reference to me; it only concerns those that have been sent, not those who sent them."

Pres. "Nimes, Montauban, Mende, Jales, felt great shocks during the first days of freedom. You did nothing to stifle those germens of counter-revolution till the moment when Saillant's conspiracy became manifestly notorious.—What have you to answer?"

Louis. "I gave, in this respect, all the orders which were proposed to me by the ministers."

Pres. "You sent 22 battalions against the Marseillois, who marched to reduce the counter-revolutionists of Arles.—What have you to answer.?"

Louis. "I ought to have the pieces referring to this matter, to give a just answer."

Pres. "You gave the southern command to Witgenstein, who wrote to you on the 21st of April 1792, after he had been recalled: 'A few instants more, and I shall call around the throne of your majesty thousands of French, who are again become worthy of the wishes you form for their happiness.'—What have you to answer?"

Louis. "This letter is dated since his recall; he has not been employed since. I do not recollect this letter."

Pres. "You paid your late life-guards at Coblentz; the registers of Septeuil attest this; and general orders signed by you prove that you sent considerable remittances to Bouillé, Rochefort, Vauguyon, Choiseul, Beaupre, Hamilton, and the wife of Polignac.—What have you to answer?"

Louis. "When I first learned that my life-guards assembled beyond the Rhine, I stopped their pay: as to the rest, I do not remember."

Pres. "Your brothers, enemies to the state, caused the emigrants to rally under their banners: they raised regiments, took up loans, and concluded alliances in your name: you did not disclaim them; but at the moment when you were fully certain that you could no longer cross their projects, your intelligence with them by a note, written by Louis Stanislaus Xavier, signed by your two brothers, was conceived in these words:

'I wrote to you, but it was by post, and I could say nothing. We are two here, who make but one; one in sentiments, one in principles, one in zeal of serving you. We keep silence; because, were we to break it too soon, it would injure you: but we shall speak as soon as we shall be certain of general support, and that moment is near. If we are spoken to on the part of those people, we shall hear nothing; but if on your part, we shall listen: we shall pursue our road straight. It is therefore desired that you will enable us to say something. Do not stand on ceremonies. Be easy about your safety: we only exist to serve you; we are eagerly occupied with this point, and all goes on well; even our enemies feel themselves too much interested in your preservation to commit an useless crime which would terminate in their own destruction.

'L. S. Xavier and
'Charles Philippe'.

"What have you to answer?"

Louis. "I disowned all the proceedings of my brothers, according as the constitution prescribed me to do, and from the moment they came to my knowledge. Of this note I know nothing."

Pres. "The soldiers of the line, who were to be put on the war establishment, consisted but of 100,000 men at the end of December, you therefore neglected to provide for the safety of the state from abroad. Narbonne required a levy of 50,000 men, but he stopped the recruiting at 26,000, in giving assurances that all was ready; yet there was no truth in these assurances. Servan proposed after him to form a camp of 20,000 men near Paris; it was decreed by the legislative assembly; you refused your sanction.—What have you to answer?"

Louis. "I had given to the ministers all the orders for expediting the augmentation of the army: in the month of December last, the returns were laid before the assembly. If they deceived themselves, it is not my fault."

Pres. "A flight of patriotism made the citizens repair to Paris from all quarters. You issued a proclamation, tending to stop their march; at the same time our camps were without soldiers. Dumourier, the successor of Servan, declared that the nation had neither arms, ammunition, nor provisions, and that the posts were left defenceless. You waited to be urged by a request made to the minister Lajard, when the legislative assembly wished to point out the means of providing for the external safety of the state, by proposing the levy of 42 battalions. You gave commission to the commanders of the troops to disband the army, to force whole regiments to desert, and to make them pass the Rhine, to put them at the disposal of your brothers, and of Leopold of Austria, with whom you had intelligence. This fact is proved by the letter of Toulougeon, governor of Franche Comté.—What have you to answer?"

Louis. "I know nothing of this circumstance; there is not a word of truth in this charge."

Pres. "You charged your diplomatic agent, to favour this coalition of foreign powers and your brothers against France, and especially to cement the peace between Turkey and Austria, and to procure thereby a larger number of troops against France from the latter. A letter of Choiseul-Gouffier, ambassador at Constantinople, verifies the fact.—What have you to answer?"

Louis. "M. Choiseul did not speak the truth: no such thing has ever been."

Pres. "The Prussians advanced against our frontiers: your minister was summoned on the 8th of July to give an account of the state of our political relations with

with Prussia; you answered, on the 10th, that 50,000 Prussians were marching against us, and that you gave notice to the legislative body of the formal acts of the pending hostilities, in conformity to the constitution.—What have you to answer?"

Louis. "It was only at that period I had knowledge of it: all the correspondence passed with the ministers."

Pres. "You entrusted Dabancourt, the nephew of Calonne, with the department of war; and such has been the success of your conspiracy, that the posts of Longwy and Verdun were surrendered to the enemy at the moment of their appearance.—What have you to answer?"

Louis. "I did not know that Dabancourt was M. Calonne's nephew. I have not divested the posts. I would not have permitted myself such a thing. I know nothing of it, if it has been so."

Pres. "You have destroyed our navy—a vast number of officers belonging to that corps had emigrated; there scarcely remained any to do duty in the harbours; meanwhile Bertrand was granting passports every day; and when the legislative body represented to you his criminal conduct on the 8th of March, you answered, that you were satisfied with his services.—What have you to answer?"

Louis. "I have done all I could to retain the officers. As to M. Bertrand, since the legislative assembly presented no complaint against him that might have put him in a state of accusation, I did not think proper to turn him out of office.

Pres. "You have favoured the maintenance of absolute government in the colonies; your agents fomented troubles and counter-revolutions throughout them, which took place at the same epoch, when it was to have been brought about in France, which indicates plainly that your hand laid this plot.—What have you to answer?"

Louis. "If there are any of my agents in the colonies, they have not spoken the truth: I had nothing to do with what you have just mentioned."

Pres. "The interior of the state was convulsed by fanatics; you avowed yourself their protector, in manifesting your evident intention of recovering by them your ancient power.—What have you to answer?"

Louis. "I cannot answer to this; I know nothing of such a project."

Pres. "The legislative body had passed a decree on the 29th of January against the factious priests; you suspended its execution.—What have you to answer?"

Louis. "The constitution reserved to me the free right to refuse my sanction of the decrees."

Pres. "The troubles had increased; the minister declared, that he knew no means in the laws extant to arraign the guilty. The legislative body enacted a fresh decree, which you likewise suspended. What have you to say to this?"

[Louis replied in the same manner as in the preceding charge.]

Pres. "The uncitizen-like conduct of the guards whom the constitution had granted you, had rendered it necessary to disband them. The day after, you sent them a letter expressive of your satisfaction, and continued their pay. This fact is proved by the treasurer of the civil list.—What have you to answer?"

Louis. "I only continued them in pay till fresh ones could be raised, according to the tenor of the decree."

Pres. "You kept near your person the Swiss guards: the constitution forbade you this, and the legislative assembly had expressly ordained their departure.—What have you to answer?"

Louis. "I have executed all the decrees that have been enacted in this respect.

Pres. "You had private companies at Paris, charged to operate movements useful to your projects of a counter-revolution. Dangremont and Gilles were two of your agents, who had salaries from the civil list. The receipts of Gilles, who was ordered to raise a company of 60 men, shall be presented to you.—What have you to answer?"

Louis. "I have no knowledge whatever of the projects laid to their charge: the idea of a counter-revolution never entered into my mind."

Pres. "You wished to suborn, with considerable sums, several members of the legislative and constituent assemblies. Letters from St Leon and others evince the reality of these deeds.—What have you to answer?"

Louis. "Several persons presented themselves with similar decrees, but I have waved them."

Pres. "Who are they that presented you with those projects?"

Louis. "The plans were so vague that I do not recollect them now."

Pres. "Who are those to whom you gave money?"

Louis. "I gave money to nobody."

Pres. "You suffered the French name to be reviled in Germany, Italy, and Spain, since you omitted to demand satisfaction for the bad treatment which the French suffered in those countries.—What have you to answer?"

Louis. "The diplomatical correspondence will prove the contrary; besides, this was a concern of the ministers."

Pres. "You reviewed the Swiss on the 10th of August at five o'clock in the morning; and the Swiss were the first who fired upon the citizens."

Louis. "I went on that day to review all the troops that were assembled about me; the constituted authorities were with me, the department, the mayor, the municipality; I had even invited thither a deputation of the National Assembly, and I afterwards repaired into the midst of them with my family."

Pres. "Why did you draw troops to the castle?"

Louis. "All the constituted authorities saw that the castle was threatened; and as I was a constituted authority, I had a right to defend myself."

Pres. "Why did you summon the mayor of Paris on the night between the 9th and 10th of August to the castle?"

Louis. "On account of the reports that were circulated."

Pres. "You have caused the blood of the French to be shed."

Louis. "No, Sir, not I."

Pres. "You authorized Septeuil to carry on a considerable

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considerable trade in corn, sugar, and coffee, at Hamburg. This fact is proved by a letter of Septeuil."

Louis. "I know nothing of what you say."

Pres. "Why did you affix a *veto* on the decree which ordained the formation of a camp of 20,000 men?"

Louis. "The constitution left to me the free right of refusing my sanction of the decrees; and even from that period I had demanded the assemblage of a camp at Soissons."

President, addressing the convention. "The questions are done with." (To Louis)—"Louis, is there any thing that you wish to add?"

Louis. "I request a communication of the charges which I have heard, and of the pieces relating thereto, and the liberty of choosing counsel for my defence."

Valazé, who sat near the bar, presented and read to Louis Capet the pieces, viz. The memoir of Laporte and Mirabeau, and some other, containing plans of a counter-revolution.

Louis. "I disown them."

Valazé next presented several other papers, on which the act of accusation was founded, and asked the king if he recognized them. These papers were the following.

Valazé. "Letter of Louis Capet, dated June 29th 1790, settling his connexions with Mirabeau and La Fayette to effect a revolution in the constitution."

Louis. "I reserve to myself to answer the contents"—(Valazé read the letter.)—"It is only a plan, in which there is no question about a counter-revolution; the letter was not to have been sent."

Valazé. "Letter of Louis Capet, of the 22d of April, relative to conversations about the Jacobins, about the president of the committee of finances, and the committee of domains; it is dated by the hand of Louis Capet."

Louis. "I disown it."

Valazé. "Letter of Laporte, of Thursday morning, March 3d, marked in the margin in the hand-writing of Louis Capet with March 3d 1791, implying a pretended rupture between Mirabeau and the Jacobins."

Louis. "I disown it."

Valazé. "Letter of Laporte without date, in his hand-writing, but marked in the margin by the hand of Louis Capet, containing particulars respecting the last moments of Mirabeau, and expressing the care that had been taken to conceal from the knowledge of men some papers of great concern which had been deposited with Mirabeau."

Louis. "I disown it as well as the rest."

Valazé. "Plan of a constitution, or revision of the constitution, signed la Fayette, addressed to Louis Capet, April 6th 1790, marked in the margin with a line in his own hand-writing."

Louis. "These things have been blotted out by the constitution."

Valazé. "Do you know this writing?"

Louis. "I do not."

Valazé. "Your marginal comments?"

Louis. "I do not."

Valazé. "Letter of Laporte of the 19th of April, marked in the margin by Louis Capet April 19. 1791, mentioning a conversation with Rivarol."

Louis. "I disown it."

Valazé. "Letter of Laporte, marked April 16. 1791, in which it seems complaints are made of Mirabeau, the abbé Perigord, André, and Beaumetz, who do not seem to acknowledge sacrifices made for their sake."

Louis. "I disown it likewise."

Valazé. "Letter of Laporte of the 23d of February 1791, marked and dated in the hand-writing of Louis Capet; a memorial annexed to it, respecting the means of his gaining popularity."

Louis. "I know neither of these pieces."

Valazé. "Several pieces without signature, found in the castle of the Thuilleries, in the gap which was shut in the walls of the palace, relating to the expences to gain that popularity."

President. "Previous to an examination on this subject, I wish to ask a preliminary question: Have you caused a press with an iron door to be constructed in the castle of the Thuilleries, and had you your papers locked up in that press?"

Louis. "I have no knowledge of it whatever."

Valazé. "Here is a day-book written by Louis Capet himself, containing the pensions he has granted out of his coffer from 1776 till 1792, in which are observed some douceurs granted to Acloque."

Louis. "This I own, but it consists of charitable donations which I have made."

Valazé. "Different lists of sums paid to the Scotch companies of Noailles, Gramont, Montmorency, and Luxembourg, on the 9th of July 1791."

Louis. "This is prior to the epoch when I forbade them to be paid."

Pres. "Louis, where had you deposited those pieces which you own?"

Louis. "With my treasurer."

Valazé. "Do you know these pension-lists of the life-guards, the one hundred Swiss, and the king's guards for 1792?"

Louis. "I do not."

Valazé. "Several pieces relative to the conspiracy of the camp of Jales, the original of which are deposited among the records of the department of L'Ardêche."

Louis. "I have not the smallest knowledge of them."

Valazé. "Letter of Bouillé, dated Mentz, bearing an account of 993,000 livres received of Louis Capet."

Louis. "I disown it."

Valazé. "An order for payment of 168,000 livres, signed Louis, indorsed Le Bonneirs, with a letter and billet of the same."

Louis. "I disown it."

Valazé. "Two pieces relative to a present made to the wife of Polignac, and to Lavauguyon and Choiseul."

Louis. "I disown them as well as the others."

Valazé. "Here is a note signed by the two brothers of the late king, mentioned in the declaratory act."

Louis. "I know nothing of it."

Valazé. "Here are pieces relating to the affair of Choiseul Gouffier at Constantinople."

Louis. "I have no knowledge of them."

Valazé.

Valazé. "Here is a letter of the late king to the bishop of Clermont, with the answer of the latter, of the 16th of April 1791."

Louis. "I disown it."

President. "Do you not acknowledge your writing and your signet?"

Louis. "I do not."

President. "The seal bears the arms of France."

Louis. "Several persons made use of that seal."

Valazé. "Do you acknowledge this list of sums paid to Gilles?"

Louis. "I do not."

Valazé. "Here is a memorandum for indemnifying the civil list for the military pensions; a letter of Dufresne St Leon, which relates to it."

Louis. "I know none of those pieces."

343 is allowed to nominate his own counsel;

When the whole had been investigated in this manner, the president, addressing the king, said, "I have no other questions to propose—have you any thing more to add in your defence?"—"I desire to have a copy of the accusation (replied the king), and of the papers on which it is founded. I also desire to have a counsel of my own nomination." Barrere informed him, that his two first requests were already decreed, and that the determination respecting the other would be made known to him in due time.

It would have been an excess of cruelty to refuse a request so reasonable in itself; it was therefore decreed that counsel should be allowed to the king, and his choice fell upon M. M. Tronchet, Lamoignon, Malesherbes, and Deseze; he had previously applied to M. Target, who excused himself on account of his age and infirmity. On the 26th of December, the king appeared for the last time at the bar of the convention; and M. Deseze read a defence which the counsel had prepared, and which was equally admired for the solidity of the argument and the beauty of the composition.

When the defence was finished, the king arose, and holding a paper in his hand, pronounced in a calm manner, and with a firm voice, what follows: "Citizens, you have heard my defence; I now speak to you, perhaps for the last time, and declare that my counsel have asserted nothing to you but the truth; my conscience reproaches me with nothing. I never was afraid of having my conduct investigated; but I observed with great uneasiness, that I was accused of giving orders for shedding the blood of the people on the 10th of August. The proofs I have given through my whole life of a contrary disposition, I hoped would have saved me from such an imputation, which I now solemnly declare is entirely groundless."

but is condemned to death by a small majority.

The discussion was fatally closed on the 16th of January. After a sitting of near 34 hours, the punishment of death was awarded by a small majority of the convention, and several of these differed in opinion from the rest, respecting the time when it should be inflicted; some contending that it should not be put in execution till after the end of the war, while others proposed to take the sense of the people, by referring the sentence to the primary assemblies.

M. Deseze then solemnly invoked the assembly in the name of his colleagues, to consider by what a small majority the punishment of death was pronounced against the dethroned monarch. "Do not afflict France (added this eloquent advocate) by a judgment that will appear terrible to her, when *five* voices only were presumed sufficient to carry it." He appealed to eternal justice, and sacred humanity, to induce the convention to refer their sentence to the tribunal of the people. "You have either forgotten or destroyed (said the celebrated M. Tronchet) the lenity which the law allows to criminals, of requiring at least *two-thirds* of the voices to constitute a definitive judgment."

The sentence was ordered to be executed in twenty-four hours.

344 And executed.

The king and his family had been for some time kept separate from each other; but he was now allowed to see them, and to choose an ecclesiastic to attend him. The meeting, and, above all, the separation from his family, was tender in the extreme. On Monday the 21st January, at eight o'clock in the morning, the unfortunate monarch was summoned to his fate. He ascended the scaffold with a firm air and step. Raising his voice, he said, "Frenchmen, I die innocent; I pardon all my enemies; and may France"—at this instant the inhuman Santerre ordered the drums to beat, and the executioners to perform their office. When they offered to bind his hands, he started back as if about to resist; but recollected himself in a moment, and submitted. When the instrument of death descended, the priest exclaimed, "Son of St Louis, ascend to heaven." The bleeding head was held up, and a few of the populace shouted *Vive la Republique*. His body was interred in a grave that was filled up with quicklime, and a guard placed around till it should be consumed.

345 Character of this unfortunate monarch.

Thus fell Louis XVI. He possessed from nature a good understanding, which, however, was blunted by the early indulgences of a court. He had a strong sense of justice, and his humanity was perhaps extreme. One defect rendered his virtues of little value, which was the possession of an irresolute and unsteady character. Unambitious, and easily advised, he was without difficulty induced to change his purposes, especially by his queen, whose connexion with the house of Austria had always tended to render his counsels unpopular. Whether he was or was not connected with the foreign invaders of his country, posterity must decide; but all men of sense and moderation must be convinced that he was murdered by a band of ruffians. Indeed a sentence so infamous, and in all respects unjust, is not to be found in the records of history. The greater part of the charges brought against him were trifling. Those which seem to be of importance relate to conduct authorized by the constitution under which he acted; and that constitution declared his person inviolable. The severest punishment that he could incur by law, was not death, but deposition; and there is no doubt, that in putting him to death the French nation broke the social compact which their representatives made with him. In a political view, this tragical event was injurious to the republican cause throughout Europe. No man out of France ventured to justify it; and in all countries it excited the most violent indignation against the rulers of the new republic.

346 Rupture with Great Britain.

New enemies were now hastening to join the general league against France. We do not mean here to enter into a detail of the political struggles that occurred in any other country, than that in the narrative of whose revolution we are now engaged. It will therefore only be necessary to remark in general, that the British government at this time thought itself endangered by the propagation of those speculative opinions which had

overturned

France. 1793.

overturned the French monarchy. Almost all the men of property in the kingdom concurred with the ministry in thinking a war with France necessary for the purpose of securing the constitution at home. After the 10th of August the British minister had been recalled; but the new republic still suffered the former ambassador from France, M. Chauvelin, to remain in England.

347 Grounds of the quarrel on the part of Great Britain.

The ostensible grounds of quarrel on the part of Great Britain were chiefly two; the decree of the 15th of November 1792, by which it was truly observed that encouragement to rebellion was held out to the subjects of every state, and that war was thereby waged against every established government. Of this decree the French executive council gave explanations, denying the fairness of the interpretation put upon it, and alleging, that the intention of the convention was only to give aid to such countries as *had already* acquired their freedom, and by a declaration of the general will requested aid for its preservation. But this explanation cannot be admitted. The decree expressly says, that the French nation will *grant assistance to all who wish to procure liberty;* and when it is considered what their notions of liberty are, it cannot be doubted but that their intention was to excite rebellion in foreign nations. The second point of dispute referred to the opening of the Scheldt. This river runs from Brabant through the Dutch territory to the sea. The Dutch had shut up the mouth of it, and prevented any maritime commerce from being carried on by the people of Brabant by means of the river. To render themselves popular in Brabant, the French had declared that they would open the navigation of the Scheldt. But Great Britain had some time before bound herself by treaty with the Dutch to assist them in obstructing this navigation, and now declared to the French, that the project of opening the Scheldt must be renounced if peace with Great Britain was to remain. The French alleged, that by the law of nations navigable rivers ought to be open to all who reside on their banks; but that the point was of no importance either to France or England, and even of very little importance to Holland; that if the people of Brabant themselves chose to give it up, they would make no objection. It has been thought remarkable, that the Dutch gave themselves no trouble about the matter. They did not ask the assistance of England; and with that coolness which is peculiar to their character, the merchants individually declared, that if the Scheldt was opened, they could manage their commerce as well at Antwerp as at Amsterdam. But in all this there is nothing strange. Among the Dutch were many republicans, who wished for the downfal of the stadtholder. These rejoiced at every thing which distressed him, or had a tendency to render his office useless in the eyes of the people. Others, who thought differently, were afraid to speak their sentiments, as Dumourier was in their neighbourhood with a victorious army. The result of the whole was, that M. Chauvelin was commanded by the British government to leave this country. The

348 War declared against the king of England, and stadtholder of Holland.

French executive council gave powers to another minister, M. Maret, to negotiate, and requested a passport for him; but he was not suffered to land. The haughty republicans having thus far humbled themselves before the British government, at last, on the 1st of February 1793, on the motion of Brissot, the national convention decreed, among other articles, that "George king of England had never ceased since the revolution of the 10th of August 1792 from giving to the French nation proofs of his attachment to the concert of crowned heads; that he had drawn into the same lake the stadtholder of the United Provinces; that, contrary to the treaty of 1783, the English ministry had granted protection to the emigrants and others who have openly appeared in arms against France; that they have committed an outrage against the French republic, by ordering the ambassador of France to quit Great Britain; that the English have stopped divers boats and vessels laden with corn for France, whilst, at the same time, contrary to the treaty of 1786, they continue the exportation of it to other foreign countries; that to thwart more efficaciously the commercial transactions of the republic with England, they have by an act of parliament prohibited the circulation of assignats. The convention therefore *declare,* that in consequence of these acts of hostility and aggression, the French republic is at war with the king of England and the stadtholder of the United Provinces.

The absurdity of pretending that any treaty with France made in 1783 could be violated by protecting the emigrants who fled from the fury of the convention, must be obvious to every reader. The convention was itself a rebellious usurpation of the government with which such a treaty was made. The prohibition of assignats was certainly contrary to no law, and was sanctioned by every motive of expediency, unless the convention could prove that all nations were bound by the law of nature to risk their own credit upon the credit of the French republic.

349 And against Spain.

About a fortnight after this absurd declaration against Britain, war was likewise declared against Spain; and in the course of the summer France was at war with all Europe, excepting only Swisserland, Sweden, Denmark, and Turkey.

350 Progress of Dumourier.

In the mean time General Dumourier, who was proceeding agreeable to his orders, made an attack upon Holland; but in doing this he dispersed his troops in such a manner as to expose them much to any attack on the side of Germany. He commanded General Miranda to invest Maestricht, while he advanced to block up Breda and Bergen-op-Zoom. The first of these places, viz. Breda, surrendered on the 24th of February; Klundert was taken on the 26th; Gertruydenberg on the 4th of March. But here the triumphs of Dumourier ended. The sieges of Williamstad and Bergen-op-Zoom were vigorously but unsuccessfully pressed.

351 He is defeated.

On the 1st of March General Clairfait having passed the Roer, attacked the French posts, and compelled them to retreat with the loss of 2000 men.

The following day the archduke attacked them anew with considerable success. On the 3d the French were driven from Aix-la-Chapelle, with the loss of 4000 men killed and 1600 taken prisoners.

The siege of Maestricht was now raised, and the French retreated to Tongres, where they were also attacked, and forced to retreat to St Tron. Dumourier here joined them, but did not bring his army along with him from the attack upon Holland. After some skirmishes, a general engagement took place at Neerwinden. It was fought on the part of the French with great obstinacy; but they were at length overpowered by the number of their enemies, and perhaps also by the treachery of their commander. This defeat was fatal. The French lost 3000 men, and 6000 immediately

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joins allies;

immediately deserted and went home to France. Dumourier continued to retreat, and on the 22d he was again attacked near Louvain. He now, through the medium of Colonel Mack, came to an agreement with the Imperialists that his retreat should not be seriously interrupted. It was now fully agreed between him and the Imperialists, that while the latter took possession of Condé and Valenciennes, he should march to Paris, dissolve the convention, and place the son of the late king upon the throne.

The rapid retreat and successive defeats of General Dumourier rendered his conduct suspicious. Commissioners were sent from the executive power for the purpose of discovering his designs. They dissembled, and pretended to communicate to him a scheme of a counter-revolution. He confessed his intention of dissolving the convention and the Jacobin club by force, which he said would not exist three weeks longer, and of restoring monarchy. On the report of these commissioners the convention sent Bournonville the minister of war to supersede and arrest Dumourier, along with Camus, Blancal, La Marque, and Quinette, as commissioners. The attempt on the part of these men was at least hazardous, to say no more of it; and the result was, that on the first of April Dumourier sent them prisoners to

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bu is army fuse to with him

General Clairfait's head-quarters at Tournay as hostages for the safety of the royal family. He next attempted to seduce his army from their fidelity to the convention; but he speedily found that he had much mistaken the character of his troops. Upon the report that their general was to be carried as a criminal to Paris, they were seized with sudden indignation; but when they found that an attempt was making to prevail with them to turn their arms against their country, their

4
Proclamation of the Imperial commander in chief.

sentiments altered. On the 5th of April, two proclamations were issued; one by General Dumourier, and the other by the prince of Saxe Cobonrg, declaring that their only purpose was to restore the constitution of 1789, 1790, and 1791. Prince Cobourg announced that the allied powers wished merely to co-operate with General Dumourier in giving to France her constitutional king and the constitution she had formed for herself, declaring, on his word of honour, that he came not to the French territory for the purpose of making conquests. On the same day Dumourier went to the advanced guard of his own camp at Maulde. He there learned that the corps of artillery had risen upon their general, and were marching to Valenciennes; and he soon found that the whole army had determined to stand by their country. Seven hundred cavalry and 800 infantry was the whole amount of those that deserted with Dumourier to the Austrians, and many of them afterwards returned.

State of France at this period.

By the defection of Dumourier, however, the whole army of the north was dissolved, and in part disbanded, in presence of a numerous, well disciplined, and victorious enemy. The Prussians were at the same time advancing on the Rhine with an immense force, and about to commence the siege of Mentz. In the interior of the republic more serious evils if possible were arising. In the departments of La Vendée and La Loire, or the provinces of Brittany and Poitou, immense multitudes of emigrants and other royalists had gradually assembled in the course of the winter. They professed to act in the name of Monsieur, as regent of France. About the middle of March they advanced against Nantz to the amount of 40,000. In the beginning of April they defeated the republicans in two pitched battles, and possessed themselves of 50 leagues of country. They even threatened by their own efforts to shake the new republic to its foundation. On the 8th of April a congress of the combined powers assembled at Antwerp. It was attended by the prince of Orange and his two sons, with his excellency Vander Spiegel, on the part of Holland; by the duke of York and Lord Auckland on the part of Great Britain; by the prince of Saxe Cobourg, Counts Metternich, Starenberg, and Mercy Dargenteau, with the Prussian, Spanish, and Neapolitan envoys. It was here determined to commence active operations against France. The prince of Cobourg's proclamation was recalled, and a scheme of conquest announced.

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Congress of the combined powers.

357
The republican army again assembled.

Commissioners from the convention now set up the standard of the republic anew, and the scattered battalions flocked around it. General Dampierre was appointed commander, and on the 13th he was able to resist a general attack upon his advanced posts. On the 14th, his advanced guard yielded to superior numbers, but on the 15th was victorious in a long and well-fought battle. On the 23d, the Austrians were again repulsed, and on the 1st of May General Dampierre was himself repulsed in an attack upon the enemy. On the 8th, another engagement took place, in which the French general was killed by a cannon ball. On the 23d, a very determined attack was made by the allies upon the French fortified camp of Famars, which covered the town of Valenciennes. The French were overcome, and in the night abandoned their camp. In consequence of this the allies were enabled to commence the siege of Valenciennes; for Condé had been blockaded from the first of April.

358
Revolt of Paoli.

About the same time General Custine on the Rhine made a violent but unsuccessful attack upon the Prussians, in consequence of which they were soon enabled to lay siege to Mentz. The Corsican general Paoli revolted at this period; and the new republic, assaulted from without by the whole strength of Europe, was undermined by treachery and faction within.

359
State of parties in France, and the revolutionary tribunal established.

While the country was in a state verging upon utter ruin, parties in the convention were gradually waxing more fierce in their animosity; and regardless of what was passing at a distance, they seemed only anxious for the extermination of each other. In the month of March, the celebrated *Revolutionary Tribunal* was established for the purpose of trying crimes committed against the state; and the Girondist party, the mildness of whose administration had contributed not a little to increase the evils of their country, began to see the necessity of adopting measures of seversity. But the public calamities, which now rapidly followed each other in succession, were ascribed by their countrymen to their imbecility or perfidy. This gave to the party of the *Mountain* a fatal advantage. On the 15th of April the communes of the 48 sections of Paris presented a petition, requiring that the chiefs of the Girondists therein named should be impeached and expelled from the convention. This was followed up on the 1st of May by another petition from the suburb of St Antoine. The Girondist party in the mean time impeached Marat, but he was acquitted by the jury at his trial. The

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Mountain, by the assistance of the Jacobin club, had now acquired a complete ascendancy over the city of Paris. The Girondists or Brissotines proposed therefore to remove the convention from the capital; and to prevent this, the *Mountain* resolved to make the same use of the people of the capital against the Girondist party that they had formerly done against the monarch on the 10th of August. It is unnecessary to state in detail all the tumults that occurred either in Paris or in the convention during the remaining part of the month of May. On the 31st, at four o'clock in the morning, the tocsin was sounded, the generale was beat, and the alarm guns fired. All was commotion and terror. The citizens flew to arms, and assembled round the convention. Some deputations demanded a decree of accusation against 35 of its members. The day, however, was spent without decision. On the afternoon of the 1st of June an armed force made the same demand. On the 2d of June this was repeated, the tocsin again sounded, and an hundred pieces of cannon surrounded the national hall. At last Barrere mounted the tribune. He was considered as a moderate man, and respected by both parties; but now he artfully deserted the Girondists. He invited the denounced members voluntarily to resign their character of representatives. Some of them complied, and the president attempted to dissolve the sitting; but the members were now imprisoned in their own hall. Henriot, commander of the armed force, compelled them to remain; and the obnoxious deputies, amounting to upwards of 90 in number, were put under arrest, and a decree of denunciation against them signed.

360 The Mountain party get the upper hand.

It is obvious, that on this occasion the liberties of France were trodden under foot. The minority of the national representatives, by the assistance of an armed force raised in the capital, compelled the majority to submit to their measures, and took the leading members prisoners. Thus the city of Paris assumed to itself the whole powers of the French republic; and the nation was no longer governed by representatives freely chosen, but by a minority of their members, whose sentiments the city of Paris and the Jacobin club had thought fit to approve of. Human history is a mass of contradictions. The *Mountain* party came into power by preaching liberty, and by violating its fundamental principles. How far the plea of political necessity may excuse their conduct, we shall not venture to decide explicitly. Certain it is, however, that they soon commenced, both at home and abroad, a career of the most terrible energy that is to be found in the annals of nations.

361 Several cities and departments revolt in consequence.

The first result of their victory in the capital was calamitous to the republic at large. Brissot and some other deputies escaped, and endeavoured to kindle the flames of civil war. In general, however, the influence of the Jacobin club, and of its various branches, was such, that the north of France adhered to the convention as it stood; but the southern departments were speedily in a state of rebellion. The department of Lyons declared the *Mountain* party outlawed. Marseilles and Toulon followed the example of Lyons, and entered into a confederacy, which has since been known by the appellation of *Fœderalism*. The departments of La Gironde and Calvades broke out into open revolt. In short, the whole of France was in a state of violent convulsion. Still, however, the enthusiastic garrisons of Mentz and Valenciennes protected it against the immediate entrance of a foreign force, and allowed leisure for one of its internal factions to gain an ascendancy, and thereafter to protect its independence. In the mean time, the political enthusiasm of all orders of persons was such, that even the female sex did not escape its contagion. A young woman of the name of Charlotte Cordé, in the beginning of July, came from the department of Calvades to devote her life for what she thought the cause of freedom and of her country. She requested an interview with *Marat*, the most obnoxious of the Mountain party. Having obtained it, and conversed with him calmly for some time, she suddenly plunged a dagger in his breast, and walked carelessly out of the house. She was immediately seized and condemned. At the place of execution she behaved with infinite constancy, shouting *Vive la Republique*. The remains of Marat were interred with great splendour, and the convention attended his funeral. His party perhaps derived advantage from the manner of his death, as it seemed to fasten the odious charge of assassination upon their antagonists, and gave them the appearance of suffering in the cause of liberty. The truth is, that assassination was sanctioned by both parties under pretence of defending the liberties of the republic.

Marat... dered ... woman

The re... lican ... stitution ... nished ... the M... tain.

One of the first acts of the Mountain junto after their triumph was to finish the republican constitution. Previous to their fall, the Girondists had brought forward the plan of a constitution, chiefly the work of Condorcet; but it was never sanctioned by the convention, and was too intricate to be practically useful. The new constitution now framed, which was afterwards sanctioned by the nation, but was never put in practice, abolished the former mode of electing the representatives of the people through the medium of *electoral* assemblies, and appointed them to be chosen immediately by the *primary* assemblies, which were to consist of from 200 to 600 citizens, each man voting by ballot or open vote at his option. There was one deputy for every 40,000 individuals, and population was the sole basis of representation. The elections were to take place every year on the 1st of May. Electoral assemblies were, however, retained for one purpose. Every 200 citizens in the primary assemblies named one elector; and an assembly of all the electors of the department was afterwards held, which elected candidates for the *executive council*, or ministry of the republic. The legislative body chose out of all this list of candidates the members of the executive council. One half of this council was renewed by each legislature in the last month of the session. Every law, after being passed by the legislative body, was sent to the department. If in more than half of the departments the tenth of the primary assemblies of each did not object to it, it became effectual. Trial by jury was established. National conventions might be called for altering the constitution, and were to be called, if required by the tenth of the primary assemblies of each department in a majority of the departments.

The publication of this constitution procured no small degree of applause to the convention and the Mountain party. The rapidity with which it was formed (being only a fortnight) seemed to cast a just reproach upon the slowness of their antagonists, and it was regarded as a proof of their being decidedly serious

rious in the cause of republicanism. No regard, however, was paid to it by the convention, which declared itself permanent, nor indeed did it seem possible to carry it into execution.

364
...of ...dé and ...encien-...

We have mentioned that Condé was invested from the beginning of April. It did not yield till the 10th of July, when the garrison was so much reduced by famine and disease, that out of 4000 men, of which it originally consisted, only 1500 were fit for service. The eyes of all Europe were in the mean time fixed upon the siege of Valenciennes. Colonel Moncrieff had contended, that batteries ought immediately to be placed under the walls, without approaching it by regular parallels; but the imperial engineer Mr Ferraris asserted, that the work of the great Vauban must be treated with more respect; and his opinion was adopted by the council of war. The trenches were opened on the 14th of June. Few sallies were attempted by the garrison, on account of the smallness of their number. The inhabitants at first wished to surrender; but the violence of the bombardment prevented their assembling or giving much trouble on that head to General Ferrand the governor. Much of the labour of the siege consisted of mines and countermines. Some of these having been successfully sprung by the allies, the town was surrendered on the 27th of July by capitulation to the duke of York, who took possession of it in behalf of the emperor of Germany. The siege of Mentz was at the same time going on. It suffered much from famine. At last, after an unsuccessful attempt by the French army on the Rhine for its relief, it surrendered on the 22d of July.

...5
Th...llied pow...s divid...as to the...u-tur...ro-cee...gs.

At the termination of the siege of Valenciennes it would appear that the allied powers were at a loss how to proceed next. The Austrian commanders are said to have presented two plans: The first was to penetrate to Paris by the assistance of the rivers which fall into the Seine; the other was to take advantage of the consternation occasioned by the surrender of Valenciennes, and with 50,000 light troops to penetrate suddenly to Paris, while a debarkation should be made on the coast of Brittany to assist the royalists. The proposal of the British ministry was, however, adopted, which was, to divide the grand army, and to attack West Flanders, beginning with the siege of Dunkirk. This determination proved ruinous to the allies. The French found means to vanquish in detail that army, which they could not encounter when united.

...6
Unfo...u-nate...onse-quen...s of the ...ision of th... force...

It has been said that the duke of York was in secret correspondence with Omeron the governor of Dunkirk; but the latter was removed before any advantage could be taken of his treachery. On the 24th of August the duke of York attacked and drove the French outposts into the town, after an action in which the Austrian general Dalton was killed. A naval armament was expected from Great Britain to co-operate in the siege, but it did not arrive. In the mean time, a strong republican force menaced the covering army of the allies, which was commanded by General Freytag. He was soon attacked and totally routed. The siege was raised. The British lost their heavy cannon and baggage, with several thousand men; and the convention, believing that their general Houchard could have cut off the duke of York's retreat, tried and executed him for this neglect of duty.

Prince Cobourg and General Clairfait in the mean time unsuccessfully attempted to besiege Cambray and Bouchain. Quesnoy was, however, taken by General Clairfait on the 11th of September; and here finally terminated for the present campaign the success of the allies in the Netherlands.

A considerable part of the French army of the north took a strong position near Maubeuge, where they were blockaded by Prince Cobourg: but upon the 15th and 16th of October he was repeatedly attacked by the French troops under General Jourdan, who succeeded Houchard. The French had now recovered their vigour. They brought into the field a formidable train of artillery, in which were many 24 pounders. Commissioners from the convention harangued the soldiers, threatened the fearful, and applauded the brave. Crowds of women, without confusion, went through the ranks, distributing spirituous liquors in abundance, and carrying off the wounded. The attacks were repeated and terrible on both sides; but the Austrians had considerably the disadvantage, and Prince Cobourg retired during the night. The French now menaced maritime Flanders. They took Furnes and besieged Nieuport. A detachment of British troops ready to sail to the West Indies were hastily sent to Ostend, and prevented for the present the farther progress of the French.

Such was the multiplicity of the events that now occurred in France, that it is difficult to state the outlines of them with any tolerable perspicuity. We have already mentioned the extensive dissensions that occurred throughout the republic in consequence of the triumph of the Mountain party on the 31st of May. The department of Calvades was first in arms against the convention, under the command of General Felix Wimpfen; but before the end of July the insurrection was quieted, after a few slight skirmishes. But the fœderalism of the cities of Marseilles, Lyons, and Toulon, still remained. Lyons was attacked on the 8th of August by the conventional troops. Several actions followed, which were attended with great loss both on the part of the assailants and of the besieged. The city was reduced almost to ruins; but it held out during the whole month of September. The besieging general Kellerman was removed from his command, on account of his supposed inactivity; and the city surrendered on the 8th of October to General Doppet, a man who had lately been a physician. Such was the rage of party zeal at this time, that the walls and public buildings of Lyons were ordered to be destroyed, and its name changed to that of *Ville Affranchie*. Many hundreds of its citizens were dragged to the scaffold on account of their alleged treasonable resistance to the convention. The victorious party, wearied by the slow operation of the *guillotine*, at last destroyed their prisoners in multitudes, by firing grape-shot upon them. Such indeed was the unrelenting character of the Mountain at this time, not only here but through the whole republic, that they themselves pretended not to excuse it, but declared that terror was with them *the order of the day*.

367
Lyons besieged by the conventional troops, and taken.

368
Unrelenting character of the conquerors.

In the end of July General Cartaux was sent against Marseilles. In the beginning of August he gained some successes over the advanced fœderalist troops. On the 24th he took the town of Aix, and the Marseillois submitted.

369
The Marseillois obliged to submit.

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submitted. But the leading people of the important town and harbour of Toulon entered into a negotiation, and submitted to the British admiral Lord Hood, under condition that he should preserve as a deposit the town and shipping for Louis XVII. and under the stipulation that he should assist in restoring the constitution of 1789. The siege of Toulon was commenced by General Cartaux in the beginning of September. It continued without much vigour during that and the whole of the succeeding month. Neapolitan, Spanish, and English troops, were brought by sea to assist in its defence. In the beginning of November, General Cartaux was removed to the command of the army in Italy, and General Dugommier succeeded him. General O'Hara arrived with reinforcements from Gibraltar, and took upon him the command of the town, under a commission from his Britannic majesty. On the 30th of November, the garrison made a powerful sally to destroy some batteries that were erecting upon heights which commanded the city. The French were surprised, and the allies succeeded completely in their object; but, elated by the facility of their conquest, the allied troops rushed forward in pursuit of the flying enemy, contrary to their orders, and were unexpectedly met by a strong French force that was drawn out to protect the fugitives. General O'Hara now came from the city to endeavour to bring off his troops with regularity. He was wounded in the arm and taken prisoner. The total loss of the allies in this affair was estimated at nearly one thousand men. The French had now mustered in full force around Toulon, and prepared for the attack. It was begun on the 19th of December in the morning, and was chiefly directed against Fort Mulgrave, defended by the British. This fort was protected by an entrenched camp, 13 pieces of cannon, 36 and 24 pounders, &c. 5 mortars, and 3000 troops. Such was the ardour of assault, that it was carried in an hour, and the whole garrison was destroyed or taken. The allies now found it impossible to defend the place; and in the course of the day embarked their troops, after having set on fire the arsenal and ships. A scene of confusion here ensued, such as has not been known in the history of modern wars. Crowds of people of every rank, age, and sex, hurried on board the ships, to avoid the vengeance of their enraged countrymen. Some of the inhabitants began to fire upon their late allies; others in despair were seen plunging into the sea, making a vain effort to reach the ships; or putting an end at once to their own existence upon the shore. Thirty-one ships of the line were found by the British at Toulon; thirteen were left behind; ten were burnt; four had been previously sent to the French ports of Brest and Rochefort, with 5000 republicans who could not be trusted; and Great Britain finally obtained by this expedition only three ships of the line and five frigates.

370 Toulon conditionally submits to Lord Hood,

371 who is at length obliged to evacuate it.

On the side of Spain the war produced nothing of importance; and in the mountainous country of Piedmont it went on slowly. Nice and Chamberry were still retained by the French; but more terrible scenes were acting in other quarters. In La Vendée a most bloody war was persisted in by the royalists. In that quarter of the country the language of the rest of France is little understood. The people were superstitious, and had acquired little idea of the new opinions that had lately been propagated in the rest of the empire. They were chiefly headed by priests, and regarded their cause as a religious one. Their mode of warfare usually was, to go on in their ordinary occupations as peaceable citizens, and suddenly to assemble in immense bands, insomuch that at one time they were said to amount to 150,000 men. They besieged Nantz and the city of Orleans, and even Paris itself was not thought altogether safe from their enterprises. The war was inconceivably bloody. Neither party gave quarter; and La Vendee proved a dreadful drain to the population of France. On the 28th of June, the conventional general Biron drove the royalists from Lucon; and Nantz was relieved by General Beysser. After some success, General Westerman was surprised by them, and compelled to retreat to Parthenay. In the beginning of August the royalists were defeated by General Rossignol; but on the 10th of that month, under Charette their commander in chief, they again attacked Nantz, but suffered a repulse. It would be tedious to give a minute detail of this obscure but cruel war. The royalists were often defeated and seemingly dispersed, but as often arose in crowds around the astonished republicans. At last, however, about the middle of October, they were completely defeated, driven from La Vendee, and forced to divide into separate bodies. One of these threw itself into the island of Noirmoutier, where they were subdued; another took the road of Maine and Brittany, where they struggled for some time against their enemies, and were at last cut to pieces or dispersed.

372 Proceedings of the royalists in La Vendee.

The royalists had long expected assistance from England; and an armament under the earl of Moira was actually fitted out for that service, but it did not arrive till too late, and returned home without attempting a landing. The Mountain party always disgraced their successes by dreadful cruelties. Humanity is shocked, and history would almost cease to obtain credit, were we to state in detail the unrelenting cruelties which were exercised against the unfortunate royalists, chiefly by Carrier, a deputy from the convention, sent into this quarter with unlimited powers. Multitudes of prisoners were crowded on board vessels in the Loire, after which the vessels were sunk. No age or sex was spared; and these executions were performed with every circumstance of wanton barbarity and insult.

373 Horrid cruelty of the Mountain party.

On the side of the Rhine a great variety of events occurred during the months of August and September. Several engagements at first took place, in which the French were, upon the whole, successful. In September, however, Landau was invested by the combined powers; and it was resolved to make every possible effort to drive the French from the strong lines of Weissembourg, on the river Lauter. On the 13th of October, the Austrian general Wurmser made a grand attack upon these lines. The French say that their generals betrayed them, and suffered the lines to be taken almost without resistance. The general of the allies confessed that the lines might have held out for several days. The French retreated to Hagenau, from which they were driven on the 18th; and suffered two other defeats on the 25th and 27th. Some of the principal citizens of Strasbourg now sent a private deputation to General Wurmser, offering to surrender the town, to be preserved as a deposit to be restored to Louis

374 Progress of the allies on the Rhine.

Louis XVII. General Wurmser refused to accept of it upon these terms, insisting upon an absolute surrender to his Imperial Majesty. In consequence of the delay occasioned by disagreement, the negotiation was discovered, and the citizens of Strasbourg engaged in the plot were seized by St Just and Lebas, commissioners from the convention, and brought to the scaffold. Prodigious efforts were now made by the French to recover their ground in this quarter. General Irembert was shot at the head of the army on the 9th of November, upon a charge, probably ill-founded, of treachery in the affair of the lines of Weissembourg. On the 14th, however, Fort Louis was taken by the allies, not without suspicion of treachery in the governor. But here the success of General Wurmser might be said to terminate. On the 21st the republican army drove back the Austrians, and penetrated almost to Hagenau. An army from the Moselle now advanced to co-operate with the army of the Rhine. On the 17th the Prussians were defeated near Sarbruck. Next day their camp at Bliescastel was stormed, and the French advanced to Deux Ponts. On the 29th and 30th the French were repulsed with great loss in two violent attacks made on the duke of Brunswick near Lautern. But it now appeared that the French had come into the field with a determination to conquer whatever it might cost. Every day was a day of battle, and torrents of blood were shed on both sides. The allies had the advantage of possessing the ground, which, in that quarter, at such a late season of the year, is very strong on account of its inequalities and morasses. In military skill, the French officers and those of the allies were perhaps nearly equal; but the French army was by far the most numerous; and although not a match in point of discipline, yet it derived no small superiority from the enthusiasm with which the troops were animated. On the 8th of December, under the command of General Pichegru, the French carried the redoubts which covered Hagenau by means of the bayonet.

375 The French at length successful in this quarter.

This modern instrument of destruction, against which no defensive weapon is employed, is always most successful in the hands of the most intrepid; and it was now a dreadful engine in the hands of French enthusiasm.—The finest troops that ever Europe produced were unable to withstand the fury of the republicans, which seemed only to increase in proportion to the multitude of companions that they lost. On the 22d the allies were driven with immense slaughter from Hagenau, notwithstanding the immense works they had thrown up for their defence. The entrenchments on the heights of Reishoffen, Jaudershoffen, &c. were considered as more impregnable than those of Jemappe. They were stormed by the army of the Moselle and the Rhine, under Generals Hoche and Pichegru. On the 23d and 24th, the allies were pursued to the heights of Wrotte. On the 26th, the entrenchments there were forced by the bayonet, after a desperate conflict. On the 27th, the republican army arrived at Weissembourg in triumph. General Wurmser retreated across the Rhine, and the duke of Brunswick hastily fell back to cover Mentz. The blockade of Landau, which had lasted four months, was raised. Fort Louis was evacuated by the allies, and Kaiserslatern, Germersheim, and Spires, submitted to the French.—During this last month of the year 1793, the loss of men on both sides in this quarter was immense, and unexampled in the history of modern war. It is even said that it might amount to more than 70,000 or 80,000 men.

376 Violent efforts of the Mountain party.

Thus far we have attended to the military affairs of the republic for some time past. Very violent efforts were in the mean time made at Paris by the new administration, established under the auspices of the Jacobin club, and of the party called the *Mountain*. The new republican constitution had been presented to the people in the primary assemblies, and accepted. The business, therefore, for which the convention was called together, that of forming a constitution for France, was at an end; and it was proposed that they should dissolve themselves, and order a new legislative body to assemble, according to the rules prescribed by that constitution. This, was, no doubt, the regular mode of procedure; but the ruling party considered it as hazardous to convene a new assembly, possessing only limited powers, in the present distracted state of the country. It was indeed obvious, that France at this time stood in need of a dictatorship, or of a government possessed of more absolute authority than can be enjoyed by one that acts, or even pretends to act, upon the moderate principles of freedom. It was therefore determined that the convention should remain undissolved till the end of the war; and that a *revolutionary* government, to be conducted by its members, should be established, with uncontrouled powers. Committees of its own body were selected for the purpose of conducting every department of business. The chief of these committees was called the *committee of public safety*. It superintended all the rest, and gave to the administration of France all the secrecy and dispatch which have been accounted peculiar to a military government, together with a combination of skill and energy hitherto unknown among mankind. A correspondence was kept up with the all Jacobin clubs throughout the kingdom. Commissioners from the convention were sent into all quarters, with unlimited authority over every order of persons. Thus a government possessed of infinite vigilance, and more absolute and tyrranical than that of any single despot, was established; and the whole transactions and resources of the state were known to the rulers. On the 23d of August, Barrere, in name of the committee of public safety, procured the celebrated decree to be passed for placing the whole French nation in a *state of requisition* for the public service. "From this moment (says the decree) till that when all enemies shall have been driven from the territory of the republic, all Frenchmen shall be in permanent readiness for the service of the army. The young men shall march to the combat; the married men shall forge arms, and transport the provisions; the women shall make tents and clothes, and attend in the hospitals; the children shall make lint of old linen; the old men shall cause themselves to be carried to the public squares, to excite the courage of the warriors, to preach hatred against the enemies of the republic; the cellars shall be washed to procure saltpetre; the saddle-horses shall be given up to complete the cavalry; the unmarried citizens, from the age of 18 to 25, shall march first, and none shall send a substitute; every battalion shall have a banner, with this inscription, *The French nation risen against tyrants*." The decree also regulates the mode of organizing this mass. A decree more tyrannical

377 France decreed to be in a state of requisition.

France. 1793.

rannical than this was never made by an eastern despot; and when it was first published, foreigners were at a loss whether to regard it as a sublime effort of a powerful government, or as a wild project which could produce nothing but confusion. The effects of it, however, have been truly terrible. We have already mentioned some of them in the bloody contest which occurred upon the Rhine, and Europe was soon destined to bear witness to still more extraordinary events.

378 General Custine tried and executed.

In the end of July, General Custine was brought to trial, and executed, in consequence of a variety of accusations of infidelity to his trust and disrespect to the convention. The queen was next brought to trial before the revolutionary tribunal, on the 15th of October.

379 Murder of the queen.

The charges against her were very various; but the chief tendency of them was to prove that she had always been hostile to the revolution, and had excited all the efforts that had been made by the court against it. On the 16th of October, this beautiful woman, whom fortune once placed so high, ended her days on a scaffold, after a mock trial, in which no regard was paid either to justice or decency. She behaved with much dignity and composure, and appeared deeply impressed with a sense of religion.

380 Execution of the heads of the Girondist party,

The members of the convention who had been at the head of the Girondist party, and had either been detained in prison since the 31st of May, or seized in the departments to which they had retired, were afterwards brought to trial. On the 30th of October, 21 of them were executed, viz. Brissot, Vergniaud, Gensonné, Duprat, Lehardi, Ducos, Fonfrede, Boilcau, Gardien, Duchatel, Sillery, Fauchet, Dufriche, Duperret, La Source, Carra, Beauvais, Mainville, Antiboul, Vigée, and Lacaze. Seventy-one were still detained in confinement.

381 and of the duke of Orleans.

The duke of Orleans was afterwards condemned, on a charge of having aspired to the sovereignty from the beginning of the revolution. His execution gave satisfaction to all parties. His vote for the punishment of death upon the trial of the late king had done him little honour even in the opinion of the Mountain, and had rendered him odious to all the rest of mankind.

382 Executions become prodigiously common.

The execution of persons of all ranks, particularly of priests and nobles, became now so common, that it would be in vain to attempt to give any detail of them. Every person brought before the revolutionary tribunal was condemned as a matter of course. The Jacobins seemed insatiable in their thirst after blood, and the people at large appeared to regard their conduct with unaccountable indifference.

383 A new table of weights and measures established.

When the human mind is once roused, its activity extends to every object. At this time a new table of weights and measures was established by the convention, in which the decimal arithmetic alone is employed. The court of Spain had the liberality, notwithstanding the war, to suffer M. Mechain to proceed in his operations for measuring a degree of the meridian in that country. He carried on his series of triangles from Barcelona to Perpignan; and from this place the mensuration was continued to Paris. M. de Lambre, and his pupil M. la Francois, also measured a degree of latitude in the vicinity of the metropolis. In all, 12 degrees of the meridian were measured; of which the mean is 57027 toises, and by this the universal standard of measure is calculated. M. M. de Borda and Cassini determined the length of a pendulum that swings seconds, *in vacuo*, and in a mean temperature at Paris, to be 3 feet and 8.06 lines. M. M. Lavoisier and Hauy found that a cubic foot of distilled water at the freezing point weighs *in vacuo* 70 pounds and 60 gros French weight. We shall insert a table of the measures and weights now established.

LONG MEASURE.

Metres.		*French Toises.*
10,000,000	= a quadrant of the meridian, which is the principle on which the new measure is founded	5132430
100,000	= an hundredth part of a quadrant, or decimal degree of the meridian	51324
1000	= a *milliare*, or mile	513
100	= a stadium } Agrarian measure	51.3243
10	= a perch } Agrarian measure	5.13243

		Feet.	*Inch.*	*Lines.*
1	= a *metre*, or rectilineal unit	3	0	11.44
$\frac{1}{10}$ or 0.1	= a *decimetre*, or palm	0	3	8.344
$\frac{1}{100}$ or 0.01	= a *centimetre*, or digit	0	0	4.434
$\frac{1}{1000}$ or 0.001	= a *millemetre*	0	0	.443

SUPERFICIAL MEASURE.

Sq. Metres.		*Sq. Feet.*
10,000	= an *are*, or superficial unit, being a square the side of which is 100 metres in length	94831
1000	= a *deciare*, or tenth of an *are*; a superficies an hundred metres long, and ten broad	9483.1
100	= a centiare	948.31

MEASURES OF CAPACITY.

Cub. decimetres.		*Paris Pints.*	*Paris Bush.*
1000	= the cubic *metre*, or cade or tun	$1051\frac{1}{2}$	78.9
190	= *dedicade*, or *setier*	$105\frac{1}{7}$	7.89
10	= *centicade*, or bushel	$10\frac{1}{2}$	.789
1	= cubic *decimetre*, or	$1\frac{1}{20}$	.0789

WEIGHTS.

Cub. decimetres of water.		*French Pounds.*
1000	= the weight of a cubic *metre*, or cade of water, is called a *bar* or *millier*	2044.4
100	= $\frac{1}{10}$ of a *bar*, or *decibar*, or quintal	204.44
10	= $\frac{1}{100}$ of a *bar*, or centibar, or *decal*	20.444

		lb.	*oz.*	*gros.*	*grains.*
1	= the weight of a cubic decimetre of water is called a *grave*, or pound	2	8	5	49
.1	= $\frac{1}{10}$ of a *grave*, or *decigrave*, or ounce	0	3	2	12.1
.01	= $\frac{1}{100}$ of a *grave*, or centigrave, or dram	0	0	2	44.41
.001	= the weight of a cubic *centimetre* of water, is named a *gravet*, or maille	0	0	0	18.841
.0001	= *decigravet*, or grain	0	0	0	1.8841
.00001	= *centigravet*	0	0	0	0.18841

A piece of silver coin weighing a *centigrave*, and a *franc* of silver, according to the former standard, will be worth 40 sols $10\frac{2}{3}$ deniers. The *milliare*, or thousand *metres*, is substituted for the mile; and the *are* for the arpent in land-measure. The latter two are to each other as 49 to 25. The astronomical circles with which M. M. de Borda and Cassini made the observations, are divided according to this plan. The quadrant contains 100 degrees, and each degree 100 minutes. Hence the minute of a great circle on our globe is equal to a *milliare*, or new French mile. If, for the reduction of this measure, we estimate the Paris toise, according to the comparison made with the standard kept in the Royal Society of London, at 6.3925 English feet, the *milliare* or minute will be equal to 1093.633 yards, and the *metre* 3.270899 feet.

384 A new kalendar formed. At the same period a new kalendar was formed.—By it the year is made to begin with the autumnal equinox, and is divided into 12 months. These are called Vindemiaire, Brumaire, Frimaire, Nivose, Ventose, Pluviose, Germinal, Floreal, Prairial, Messidor, Thermidor, and Fructidor. The months consist of 30 days each, and are divided into three decades. The days of each decade are known by the names of Primidi, Duodi, Tridi, &c. to Decadi; and the day of rest is appointed for every tenth day, instead of the seventh. The day (which begins at midnight) is distributed into ten parts, and these are decimally divided and subdivided. Five supernumerary days are added every year after the 30th of Fructidor. To these is given the absurd appellation of *Sans Culotides*, a word borrowed from a term of reproach (*sans culotte*), which had often been bestowed on the republican party from the meanness of their rank and fortune; but which that party now attempted to render honourable and popular. The childish folly of this innovation has struck every person with surprise, as it can serve no good purpose whatever. It is a wonderful instance of the waywardness of the human mind, which can occupy itself one moment with deeds of savage barbarity, and the next with a matter so unimportant as the artificial division of time.

385 Decay of religion. The religion of France had been gradually losing its influence; and on the 7th of November, Gobet, bishop of Paris, along with a great multitude of other ecclesiastics, came into the hall of the convention, and solemnly resigned their functions and renounced the Christian religion. All the clergymen, whether Protestant or Catholic, that were members of the convention, followed this example, excepting only Gregoire, whom we formerly mentioned as having been one of the first priests that joined the *Tiers Etat* after the meeting of the States General. He had the courage to profess himself a Christian, although he said that the emoluments of his bishopric were at the service of the republic. With the acclamations of the convention, it was decreed that the only French deities hereafter should be Liberty, Equality, Reason, &c. and they would seem to have consecrated these as a kind of new objects of worship.—What political purpose the leaders in the convention intended to serve by this proceeding does not clearly appear; unless, perhaps, their object was to render the French manners and modes of thinking so completely new, that it should never be in their power to return to the state from which they had just emerged, or to unite in intercourse with the other nations of Europe. The populace, however, could not at once relinquish entirely the religion of their fathers. The commune of Paris ordered the churches to be shut up, but the convention found it necessary to annul this order; and Robespierre gained no small degree of popularity by supporting the liberty of religious worship on this occasion. Hebert and Fabre d'Eglantine, who led the opposite party, hastened their own fall by this ill-judged contempt of popular opinion.

For, now that the republic saw itself successful in all quarters, when the Mountain party and the Jacobins had no rival at home, and accounted themselves in no immediate danger from abroad, they began to split into factions, and the fiercest jealousies arose. The Jacobin club was the usual place in which their contests were carried on; and at this time Robespierre acted the part of a mediator between all parties. He attempted with great art to turn their attention from private animosities to public affairs. He spread a report that an invasion of Great Britain was speedily to take place. He therefore proposed that the Jacobin club should set themselves to work to discover the vulnerable parts of the British constitution and government. They did so: They made speeches, and wrote essays without number. And in this way was the most fierce and turbulent band of men that ever perhaps existed in any country occupied and amused for a very considerable time. What is no less singular, a great number of British subjects favoured the plans of these reforming Atheists, and, under the specious appellation of the *Friends of the People*, acted in concert with the French Jacobins. 386 Quarrels between the Mountain and Jacobins.

The winter passed away in tolerable quietness, and no military enterprise was undertaken either by the allies or by the French. On the 1st of February, Barrere asserted in the convention that the confederate powers were willing *provisionally* to acknowledge the French republic, to consent to a cessation of hostilities for two years, at the end of which a lasting peace should be ratified by the French people. But this proposal the convention declared itself determined to reject, as affording to the other nations of Europe the means of undermining their new government. 387 A provisional acknowledgement of the republic by the allies rejected by the convention. In the mean time, the revolutionary government was gradually becoming more vigorous. Thirty committees of the convention managed the whole business of the state, without sharing much of the direct executive government, which rested in the committee of public safety. These different committees were engaged in the utmost variety of objects. The ruling party had no competitors for power. Without confusion or opposition, therefore, the most extensive plans were rapidly carried into effect. The convention was little more than a court in which every project was solemnly registered. In the same session 30 decrees would sometimes be passed upon objects the most widely different. 388 Vigorous state of the revolutionary government. The finances were under one committee, at the head of which was Cambon.—This committee found resources for the most lavish expenditure. The assignats were received as money throughout the state; and thus a paper mill was said to have become more valuable than a mine of gold. Their credit was supported by an arbitrary law regulating the *maximum* or highest price of provisions, and by the immense mass of wealth which had come into the hands of the convention by seizing the church lands, and by confiscating 389 Management of the finances and other resources of the nation.

France. 1794. confiscating the property of royalists, emigrants, and persons condemned by the revolutionary tribunal. So unequally had property been divided under the ancient government, that by means of these confiscations about seven-tenths of the national territory was supposed to be in the hands of the public. To this was added the plunder of the churches, consisting of gold and silver saints, and utensils employed in divine worship, along with other articles of less value; among which may be mentioned the innumerable church bells, which were regarded as sufficient for the manufacture of 15,000 pieces of cannon. These resources formed a mass of property such as never was possessed by any government.

Other committees were engaged in very different objects. Highways were constructed, and canals planned and cut throughout the country. Immense manufactories of arms were everywhere established. At Paris alone 1100 muskets were daily fabricated, and 100 pieces of cannon cast every month. Public schools were assiduously instituted, and the French language taught in its purity from the Pyrenees to the Rhine. The French convention possessed immense resources, and they did not hesitate to lavish them upon their schemes. Every science and every art was called upon for aid, and the most accomplished men in every profession were employed in giving splendour to their country. The chemists, in particular, gave essential aid by the facility with which they supplied materials for the manufacture of gun-powder; and in return for their services, Lavoisier, the greatest of them, suffered death by a most iniquitous sentence. Not fewer than 200 new dramatic performances were produced in less than two years; the object of which was to attach the people to the present order of things. The vigour with which the committees of subsistence exerted themselves is particularly to be remarked. As all Europe was at war with France, and as England, Holland, and Spain, the three maritime powers, were engaged in the contest, it had been thought not impossible to reduce France to great distress by famine, especially as it was imagined that the country had not resources to supply its immense population. But the present leaders of that country acted with the policy of a besieged garrison. They seized upon the whole provisions of the country, and carried them to public granaries. They registered the cattle, and made their owners responsible for them.—They provided the armies abundantly, and, as the people were accurately numbered, they dealt out in every district, on stated occasions, what was absolutely necessary for subsistence, and no more. To all this the people submitted; and, indeed, throughout the whole of the mixed scenes of this revolution, the calm judgment of the historian is not a little perplexed. We cannot avoid admiring the patience with which the people at large endured every hardship that was represented as necessary to the common cause, and the enthusiastic energy with which they lavished their blood in defence of the independence of their country. At the same time we must regard with indignation and disgust the worthless intrigues by means of which the sanguinary factions in the convention and the capital alternately massacred each other.

390 Dissensions of the Jacobins increase.

During the winter the dissensions of the Jacobins still increased. They were divided into two clubs, of which the new one assembled at a hall which once belonged to the Cordeliers. The leaders of it were Hebert, Ronsin, Vincent, and others; but the old society retained its ascendency, and Robespierre was now decidedly its leader. This extraordinary man had gradually accumulated in his own person the confidence of the people and the direction of the government. As the committees were above the convention, which was become little more than a silent court of record, so the committee of public safety was above the other committees. Robespierre was the leader of this ruling committee. Barrere, St Just, Couthon, and others of its members, only acted a secondary part. They laboured in the business of the state, but the radical power was with Robespierre. He surrounded the members of the convention with spies. He was jealous and implacable, and set no bounds to the shedding of blood. On the 25th of March he brought to trial the following active Jacobins, who were condemned and executed on the following day: Hebert, Ronsin, Momoro, Vincent, Du Croquet, Koch, Col. Laumur, M. M. Bourgeois, Mazuel, La Boureau, Ancard, Le Clerc, Proly, Dessieux, Anacharsis Cloots, Pereira, Florent, Armand, Descombles, and Dubuisson. Not satisfied with this, on the 2d of April he brought to trial nine of those who had once been his most vigorous associates, Danton, Fabre d'Eglantine, Bazire, Chabot, Philippeaux, Camille Desmoulins, Lacroix, Delaunay d'Angers, Herault de Sechelles, who, along with Westerman, were executed on the evening of the 5th.

391 Preparations for the campaign of 1794, and plan of the allies.

Still, however, the preparations for the ensuing campaign were proceeding with unabated vigour. The committee for military affairs, at the head of which were Carnot, La Fitte, d'Anissi, and others, was busy in arranging along the frontiers the immense force which the requisition had called forth. Plans of attack and defence were made out by this committee; and when approved by the committee of public safety they were sent to the generals to be executed. On the other side, the allies were making powerful preparations for another attempt to subjugate France. The emperor himself took the field at the head of the armies in the Netherlands. The plan of the campaign is said to have been formed by the Austrian colonel Mack. West Flanders was to be protected by a strong body of men; the main army was to penetrate to Landrecies, and getting within the line of French frontier towns, it was to cut them off from the interior by covering the country from Maubeuge to the sea. The plan was *bold*. It belongs to military men to judge whether this was not its only merit. When attempting to put it into execution, the allies must have been ill informed of the immense force which the French were collecting against them. Even the town of Lisle alone, which was capable of containing a numerous army within its walls, and which was to be left in their rear, should have seemed an insurmountable objection to the plan.

392 State of the allied armies.

On the 16th of April the Austrian, British, and Dutch armies assembled on the heights above Cateau, and were reviewed by the emperor. On the following day they advanced in eight colums against the French, drove in their whole posts, and penetrated beyond Landrecies; which place the French attempted to relieve, but without success. The allied army now amounted to 187,000 men, who were disposed in the following manner; 15,000 Dutch and 15,000 Austrians, under the prince of Orange and General Latour, formed the siege

siege of Landrecies; 15,000 British, and 15,000 Austrians, commanded by the duke of York and General Otto, encamped towards Cambray. The emperor and the prince of Saxe-Cobourg, at the head of 60,000 Austrians, were advanced as far as Guise; 12,000 Hessians and Austrians under General Worms were stationed near Douay and Bouchain; Count Kaunitz with 15,000 Austrians defended the Sambre and the quarter near Maubeuge; and lastly, General Clairfait, with 40,000 Austrians and Hanoverians, protected Flanders from Tournay to the sea; 60,000 Prussians, for whom a subsidy had been paid by Great Britain, were expected in addition to these, but they never arrived.

The French now commenced their active operations. On the morning of the 26th of April they attacked the duke of York near Cateau in great force. After a severe conflict they were repulsed, and their general Chapuy was taken prisoner. At the same time they attacked the troops under his Imperial majesty, but were there also repulsed in a similar manner; losing in all 57 pieces of cannon. On the same day, however, General Pichegru advanced from Lisle, attacked and defeated General Clairfait, took 32 pieces of cannon; and, in the course of a few days, made himself master

393 Fall of Landrecies.

of Vervic, Menin, and Courtray. On the 29th of April, the garrison of Landrecies surrendered to the allies. When this event was known in the convention, it excited a considerable degree of alarm. It was, however, the last effectual piece of success enjoyed by the allies during this disastrous campaign. General Clairfait was again completely defeated by Pichegru in a general engagement; and it was found necessary to send the duke of York to his assistance. This movement was no doubt unavoidable; but the effect of it was, that it split down the allied army into a variety of portions, capable of carrying on a desultory warfare, but unfit for the vigorous objects of conquest. On the 10th of May the duke of York was attacked near Tournay by a body of the enemy, whom he repulsed; but he was unable to join Clairfait, upon whose de-

394 Success of Pichegru in West Flanders.

struction the French were chiefly bent: for at the same time that the duke of York was occupied by the attack upon himself, Pichegru fell upon Clairfait with such irresistible impetuosity, that he was compelled to retreat in confusion, and a part of his army appears to have fled to the neighbourhood of Bruges. While Pichegru was thus advancing successfully in West Flanders, General Jourdan advanced in East Flanders from Maubeuge, crossed the Sambre, and forced General Kaunitz to retreat. On the 18th, however, General Kaunitz succeeded in repulsing the enemy in his turn, and they re-crossed the Sambre with considerable loss.

The allies now found that no progress could be made in France while General Pichegru was advancing successfully and occupying West Flanders in their rear. The emperor, therefore, withdrew the greater part of his army to the neighbourhood of Tournay, and resolved to make a grand effort to cut off the communication between Courtray and Lisle, thus to prevent completely the retreat of Pichegru. On the night of the 16th, the army moved forwards in five columns for this purpose. Clairfait was at the same time directed to cross the Lys, to effect a general junction, if possible, and complete the plan. The attempt during that evening seemed to promise success; but, in the course of next day, the division under the duke of York was overpowered by numbers and defeated. The progress of the rest of the columns was stopped, and Clairfait completely defeated. In the confusion of the day, when attempting to rally the different parts of the division which he commanded, the duke of York was separated from his own troops by a party of the enemy's cavalry, and only escaped being made prisoner by the swiftness of his horse. The plan of the allies being thus frustrated, their army withdrew to the neighbourhood of Tournay.

Pichegru speedily attempted to retaliate against the allies. On the 22d of May he brought down at daybreak his whole force against them. The attack was commenced by a heavy fire of artillery, and all the advanced posts were forced. The engagement soon became general; the attacks were repeatedly renewed on both sides; the whole day was spent in a succession of obstinate battles. All that military skill could do was performed on both sides. The French and the allied soldiers fought with equal courage and equal discipline. At nine o'clock in the evening the French at last reluctantly withdrew from the attack. The day on which a vanquished enemy flies from the field is not always that on which the victory is won. In this engagement the French were unsuccessful in their immediate object; but the weight of their fire, their steady discipline, and their violent obstinacy of attack, raised their military character high in the estimation of the officers and soldiers of the allied army. It was soon perceived, that in addition to these they possessed other advantages. Their numbers were immense; they implicitly obeyed their generals; who, being men newly raised from the rank of subalterns, as implicitly submitted to the directions of the committee of public safety. A combination of efforts was thus produced, whose operation was not retarded by divided counsels. On the other side the numbers of the allies were daily declining; their leaders were independent princes or powerful men, whose sentiments and interests were often very hostile to each other, and their exertions were consequently disunited.

On the 24th the French again crossed the Sambre, but were driven back with much loss. On the 27th an attempt was made to besiege Charleroi, but the prince of Orange on the 3d of June compelled them to raise the siege. On the 12th a similar attempt was

made, and they were again repulsed. In West Flan- 395 He lays siege to Ypres, and

ders, however, Pichegru was sufficiently strong to commence the siege of Ypres. He was soon attacked by General Clairfait for the purpose of relieving it, but without success. Ypres was garrisoned by 7000 men; reinforcements were therefore daily sent from the grand army to Clairfait for the purpose of relieving it. It is unnecessary to mention the bloody contests in which that unfortunate general was daily engaged with the French. It is sufficient to say, that they were uniformly unsuccessful, and were the means of wasting,

in a great degree, the armies of the allies. Ypres held 396 takes it.

out till the 17th of June, when it capitulated: and such was the discipline of the French army at this time, that no notice could be obtained, for several days, of that event. But in consequence of this and of other events, the duke of York found it necessary to retreat to Oudenarde; for Jourdan, after storming the Austrian camp of

France. 1794.

of Betignies, now advanced with such strength upon Charleroi in the east that its immediate fall was feared. As this would have enabled the two French armies to encircle the whole of Flanders, the prince of Cobourg advanced to its relief. Charleroi surrendered at discretion on the 25th. This circumstance was not known by the prince of Cobourg when he advanced on the 26th to attack in their entrenchments the army that covered the siege near Fleurus: but the covering army being by this time reinforced by the accession of the besieging army, the allies were repulsed. Jourdan then drew his men out of their entrenchments; and, in his turn, attacked the Austrians. He was three times repulsed, but was at last successful: the loss of the vanquished army is said to have been prodigious; but no regular accounts of it have been published. The French unquestionably exaggerated their own success, when they said that it amounted to 15,000 men.

397 Charleroi surrendered, and the Austrians defeated.

398 Further successes of the French in Flanders.

The allies now retreated in all quarters. Nieuport, Ostend, and Bruges, were taken; and Tournay, Mons, Oudenarde, and Brussels, opened their gates. At this last place, the French armies of East and West Flanders united. Landrecies, Valenciennes, Conde, and Quesnoi, were fruitlessly left with garrisons in them. The allied troops, evacuating Namur, formed a line from Antwerp to Liege to protect the country behind. The French advanced in full force, and attacked General Clairfait, cut to pieces half the troops that now remained under him, and broke the line. The allies retreated before them. The duke of York was joined by some troops under the earl of Moira that with much difficulty had made their way to him from Ostend; and with these and the Dutch troops he retired to the neighbourhood of Bergen-op-zoom and Breda for the protection of Holland. The prince of Cobourg evacuated Liege, crossed the Maese, and placed a garrison in Maestricht. He soon, however, sent back a part of his troops to the neighbourhood of Tongres; for here, to the astonishment of all Europe, the French armies made a voluntary pause in their career of victory, and ceased to pursue their retiring foes. Sluys in Dutch Flanders was the only foreign post that they continued to attack, and it surrendered after a siege of 21 days.

399 And on the Rhine.

On the Rhine the war was equally successful on the part of the French. On the 12th, 13th, and 14th of July, repeated battles were fought; in which the French enjoyed their usual success. They had numerous armies in every quarter. Their mode of fighting was to make full preparation for accomplishing their object, and to fight in great bodies day after day till it was obtained. The Palatinate was then overrun, and Treves taken, by General Michaud. Flanders and the Palatinate have always been accounted the granaries of Germany; and both of them, at the commencement of the harvest, now fell into the hands of the French.

400 Corsica subdued by Great Britain.

During the course of this summer Corsica was subdued by Great Britain; and the whole of the French West India islands, excepting a part of Gaudaloupe, yielded to the British troops under the command of Sir Charles Grey and Sir John Jarvis. On the 1st of June the British fleet, under the command of Earl Howe, gained a most splendid victory over the French fleet to the westward of Ushant. The French committee of safety were known to have purchased in America immense quantities of grain and other stores. These were embarked on board 160 sail of merchantmen, convoyed by six sail of the line. Lord Howe sailed to intercept this valuable convoy. The French fleet sailed at the same time to protect it. On the morning of the 28th of May the fleets came in sight of each other. The British admiral had previously dispatched six ships of the line under Admiral Montague to intercept the French convoy, while he should engage and detain the grand fleet. The French dispatched eight sail to defeat this attempt. In the course of the 29th Lord Howe got to windward of the French fleet. His force was 25, and theirs was 26, sail of the line. The following day he bore down upon them, and broke their line. The engagement was one of the severest ever fought. The French admiral, in less than an hour after the close action commenced in the centre, crowded off with 12 of his ships. The British fleet was so much disabled, or separated, that several of the French dismantled ships got away under sails raised on the stump of their foremasts. Seven sail of the line, however, remained in possession of the British, and two were unquestionably sunk. In the mean time, Admiral Montague fell in with the French convoy, but it was now guarded by 14 sail of the line. As he could not encounter such a force, he returned home, and it was safely conveyed into port. Thus, by one of those contradictions which so often occur in human affairs, the British fleet was victorious, and the French were left in some measure masters of the sea. As this engagement however testified that the British seamen had not lost their ancient superiority on their own element, the nation regarded the present victory as a pledge of its independence, and very general rejoicings took place in consequence of it.

France. 1794.

401 Splendid victory of the British fleet under Lord Howe.

402 The hor[rid] executio[ns] at Paris continue.

In the mean time, the revolutionary system of government in the hands of committees of the convention at Paris, and of committees of the popular societies throughout the country, was arrived at its highest perfection, and proceeded without opposition in its severe and sanguinary measures.

On the 10th of May Madame Elizabeth, sister of the late king, was sacrificed by it, in consequence of a decree of the revolutionary tribunal. Multitudes of others of every rank and sex were daily sacrificed in a similar manner; the rich in particular were the great objects of persecution, because the confiscation of their property added to the strength of the ruling powers. But neither were the poor safe from the bloody vigilance of this new and singular government. By the different executions Robespierre had contrived to destroy every avowed rival. All the constituted authorities consisted wholly of persons nominated with his approbation; and as the committees which conducted the business of the state were at his disposal, his will was irresistible throughout the republic. He met with no opposition in the convention; for that body was no longer the turbulent popular assembly which it had once appeared; it was little more than a name employed to give some sort of respectability to such schemes as were proposed to it.

403 Immense power of Robespierre.

404 Verging to ruin.

Amidst this accumulation, however, of seemingly irresistible authority, Robespierre was at the brink of ruin. The whole of the old Girondist party was indeed subdued and silent; but many members of the convention still remained attached to it. The party of the Mountain, France. 1794. Mountain, by means of whom Robespierre had risen to power, with little satisfaction now found themselves not only disregarded, but ready at every instant to fall a sacrifice to that system of terror which they had contributed to erect. Even the Jacobins themselves, though neither timid nor cautious in the shedding of blood, began to murmur when they saw that awful privilege confined exclusively within a few hands, or rather monopolized by an individual. In this state things remained for some time; and it appeared how possible it is for an individual to govern a great nation, even while the whole of that nation is hostile to his power. The banishment or imprisonment of all foreigners, which had long been rigorously practised, prevents us from possessing much accurate information concerning the internal state of France at this period; but it is certain that one circumstance in particular tended much to accelerate the fall of Robespierre. He had procured a decree to be passed, authorizing the committee of public safety to imprison at its pleasure, and bring to trial, any member of the convention. All the individuals of that body found themselves placed by this decree in the hands of a man whose severe and suspicious temper they well knew. Still, however, they were so much surrounded by spies, that it was difficult to form a party or plan of operations; even the majority of the committee of public safety were among the number of the discontented, but they

405
Particulars of his fall.

dared not to withstand their chief. At last, on the 25th of July, the convention began to give signs of agitation. It was understood, that in the course of a few days Robespierre would sacrifice a number of the members to his suspicions. On the following day the sitting of the convention was still more tempestuous. In a long speech Robespierre defended his own conduct against those who had reproached him with aspiring to the dictatorship of France. He attacked the party whom he styled *Moderates*, as wishing to overturn the revolutionary government, and to restore the feeble system of the Brissotines. The result of a long debate was, that Robespierre was apparently victorious, and his speech was ordered to be printed. On the 27th the convention appeared ripe for a change: St Just, a member of the committee of public safety, in attempting to defend Robespierre, was repeatedly interrupted; and Billaud Varennes stood forward, and enumerated the crimes, and proclaimed the tyranny, of Robespierre. The speech was received with bursts of applause. Robespierre in vain attempted to defend himself; he was silenced by shouts of execration from every part of the hall. Tallien seconded the former speaker in his accusation. The sitting was declared permanent, and a decree of arrest was passed against Robespierre and a younger brother of his, along with St Just, Couthon, and Lebas. These men left the convention, and found security in the hall of the commune of Paris; where the municipal officers agreed to protect and stand by them. The tocsin was sounded; the armed force was under their command; an insurrection was therefore attempted against the convention: but the sections of Paris refused their support. Very few of the troops could be collected, and these were not firm; the late tyranny had become odious. The hall of the commune was therefore speedily surrounded; and about three o'clock in the morning of the 28th Robespierre and his associates were made prisoners. They had been outlawed by the convention on account of their resistance. They were not therefore tried, unless for the purpose of identifying their persons; and, in the course of that day, they were executed; 60 of the municipal officers were also executed for joining in the rebellion; and in this way a storm passed over, which at one time threatened to involve the French capital in ruin, and filled all Europe with astonishment. Thus also terminated the career of the most extraordinary man that the French revolution had brought forward. His talents were undoubtedly considerable, and his ambition knew no bounds, bidding defiance to the ordinary feelings of humanity. Had Dumourier possessed his coolness and caution, or had he possessed the military talents of Dumourier, the convention would certainly have been overturned, and we should have seen a second Cromwell on the throne of his murdered sovereign.

406
The system of terror gives place to that of moderatism.

After the fall of Robespierre, the convention exhibited no small change of appearance. Instead of that silence which formerly prevailed, all was bustle and noise; all accused each other. There was no longer any leader, and there was no formed party. The former system of terror was declared to be at an end, and a new system of *moderatism* succeeded. This was carried to as great a height as the system of terror had formerly been; and all means were taken to render popular the fall of their late tyrant. The committees were organized anew, and their members ordered to be frequently changed. The correspondence between the affiliated Jacobin clubs was prohibited, and at last the Jacobin club itself was abolished. This last event was accomplished with ease; and that society which had been the great engine of the revolution, was itself without resistance overturned. Seventy-one deputies of the Girondist party, who had been imprisoned since the 31st of May 1793, were set at liberty. The name of Lyons was restored to it. Some of the agents of Robespierre were punished, particularly the infamous Carrier, whose cruelties in La Vendée we formerly mentioned. Still, however, the convention appeared so little united and so little decided with regard to objects of the first importance, that in all probability they would not have conducted the important struggle against the nations of Europe with more success than the Girondist party had formerly done, if the revolutionary government and the late system of terror had not already accumulated in their hands such vast resources, and traced out such a plan of procedure, as rendered it an easy matter to preserve their numerous armies in the train of success to which they were now habituated.

407
The French towns strongly garrisoned by the allies surrender without resistance.

The allies in their retreat had left strong garrisons in the French towns which had surrendered to them. These were Condé, Valenciennes, Quesnoi, and Landrecies. They now surrendered to the republican armies with so little resistance, that the conduct of the emperor began to be considered as ambiguous, and he was suspected of having entered into some kind of compromise with the French. This idea proved erroneous; and as soon as the army which had besieged these towns was able to join the grand army under Pichegru and Jourdan, the operations of the campaign were resumed after a suspension of almost two months. The French army divided itself into two bodies. One of these under Jourdan advanced against General Clairfait, who had succeeded the prince of Cobourg in the command in

France 1794.

408 Further successes of the French.

in the neighbourhood of Maestricht. On the 15th of September the French attacked the whole Austrian posts in an extent of five leagues from Liege to Maestricht. On that and the following day the losses were nearly equal. On the 17th the French with 50 pieces of cannon attacked General Kray in his entrenched camp before Maestricht. M. de Kray was already retiring when General Clairfait arrived with a strong reinforcement, and after a severe combat the French were once more compelled to retire. On the 18th the French renewed the attack with tenfold fury upon every part of the Austrian line, and the whole was compelled to fly to the neighbourhood of Aix-la-Chapelle. General Clairfait now chose a strong position on the banks of the Roer, where he even declared it to be his wish that he might be attacked. But by this time the spirit of his army was humbled, desertions became numerous, and the want of discipline was extreme. On the first of October the French crossed the Maese and the Roer, and attacked the whole Austrian posts from Ruremond down to Juliers. After a bloody engagement, the brave and active, though unfortnnate, General Clairfait was compelled hastily to cross the Rhine, with the loss of 10 or 12,000 men. The French general did not attempt to cross that river, but one detachment of his army took possession of Coblentz, while others laid close siege to Venlo and Maestricht, which soon surrendered.

409 And their progress in the conquest of Holland.

The division of the French army, in the mean time, under General Pichegru, came down upon Holland, and attacked the allied army under the duke of York between Bois-le-duc and Grave. They forced the advanced post of Boxtel. Lieutenant-general Abercromby was sent to attempt to recover this post on the 15th of September, but he found the French in such force that he was obliged to retreat. Indeed the French were discovered to be no less than 80,000 strong in that neighbourhood. The duke of York was unable to contend against a force so superior, and retired across the Maese with the loss of somewhat less than 1500 men. Pichegru immediately laid siege to Bois-le-duc. On the 30th of September, Crevecœur was taken, and Bois-le-duc surrendered in 10 days thereafter. In it 408 French emigrants were taken prisoners; and these, as well as 760 that had been taken at Nieuport, 500 at Sluys, and 1100 at Valenciennes, were all put to death, agreeable to the rigorous law formerly made by the convention. The French now followed the duke of York across the Maese. Upon this the greater part of the allied army under his royal highness crossed the Rhine and took post at Arnheim. The remaining part of the army followed soon after, and Nimeguen was occupied by the French on the 6th of November. The duke of Brunswick was at this time requested to take the command of the allied army, to protect Holland, if possible. He came to Arnheim for that purpose; but after examining the state of things there, he declined the undertaking. The allied troops had now so often fled before their victorious and almost innumerable enemies, they had so often been in want of every necessary, and had been received so ill by the inhabitants of the countries through which they passed, among whom the French cause was extremely popular, that they had lost that regularity of conduct and discipline which alone can afford a secure prospect of success in military affairs.

410 Conduct, discipline, and state of the French armies.

The French, on the contrary, well received, abounding in every thing, and proud of fighting in a popular cause, now acted with much order, and submitted to the strictest discipline. In addition to all these advantages, the French leaders had the dexterity to persuade the world that new and unknown arts were employed to give aid to their cause. At this period the *telegraph* was first used for conveying intelligence from the frontiers to the capital, and from the capital to the frontiers. (See Telegraph). Balloons were also used by the French during this campaign to procure knowledge of the position of the enemy. An engineer ascended with the balloon, which was suffered to rise to a great height, but prevented from flying away by a long cord. He made plans of the enemy's encampment; and during an attack he sent down notice of every hostile movement. In the affairs of men, and more especially in military transactions, opinion is of more importance than reality. The French soldiers confided in their own officers as men possessed of a kind of omniscience, while the allied troops, no doubt, beheld with anxiety a new contrivance employed against them, whose importance wonld be readily magnified by credulity and ignorance. With all these advantages, however, after the capture of Nimeguen, they once more made a halt in their career, and abstained from the attack of Holland, which now seemed almost prostrate before them.

411 Their successes in Spain.

While these events occurred in the north, the French arms were scarcely less successful on the side of Spain. In the Western Pyrenees, Fon-Bellegarde was taken; in the Western Pyrenees, Fontarabia surrendered, and also St Sebastian; the whole kingdom of Spain seemed panic struck. That feeble government, with an almost impregnable frontier, and the most powerful fortresses, could make little resistance; and the difficult natnre of their country was their only protection. The history of this war is only a history of victories on the part of the French. In the Eastern Pyrenees, on the 17th November, the French general Dugommier was killed in an engagement, in which his army was successful. On the 20th of that month the French again attacked the Spaniards, and routed them by means of the bayonet, without firing a single musket-shot. Tents, baggage, and cannon, for an army of 50,000 men, fell into the hands of the conquerors, along with a great part of the province of Navarre. Towards the end of the year, an army of 40,000 Spaniards, entrenched behind 80 redoubts, the labour of six months, suffered themselves to be completely routed; their general Count de la Union was found dead on the field of battle, and the whole Spanish artillery was taken. In three days thereafter, the fort Fernando de Figuieres, containing a garrison of 9107 men, surrendered, although it mounted 171 pieces of cannon, and possessed abundance of provisions. The French continued their conquests; Rosas was taken, and the whole province of Catalonia was left at the mercy of the invaders.

412 The conquest of Holland completed.

The successes of this wonderful campaign were not yet terminated; and the last part of them is perhaps the most important, although no great effort was necessary to its execution. The winter now set in with uncommon severity. For some years past the seasons of Europe had been uncommonly mild; there had been little frost in winter, and no intense heat in summer. But during the late season the weather had long been remarkably ance. 95.

markably dry till the latter part of harvest, when there fell a considerable, though by no means unusual, quantity of rain. Towards the end of December a severe frost bound up the whole of the rivers and lakes of Holland. The Waal was frozen over in the beginning of January; a circumstance which had not occurred for 14 years past. Taking advantage of this, the French crossed that river, and with little opposition seized the important pass of Bommell, which at other seasons is so strong by its inundations. The allied army had been joined by 17,000 Austrians, and had received orders to defend Holland to the last. They did so, and were successful in repulsing the French for some days between the Waal and the Leck; but the republican army, amounting to 70,000 men, having at last advanced in full force, the allied troops were compelled to retire across the Yssel into Westphalia. In the course of their march through this desert country, in the midst of severe frost and a deep snow, they are said to have suffered incredible hardships, and to have lost a very great number of men. The French, in the mean time, advanced rapidly across the country to the Zuyder sea, to prevent the inhabitants from flying, and carrying off their property. On the 16th of January 1795, a party of horse, without resistance, took possession of Amsterdam. The other towns surrendered at discretion. In consequence of an order from the states general, the strong fortresses of Bergen-op-zoom, Williamstadt, Breda, &c. opened their gates to the French. The fleet and the shipping were fixed by the intense frost in their stations, and fell a prey to the enemy; who thus, with a little effort, made a complete conquest of this populous and once powerful country. The French were well received by the people at large. The power of the stadtholder had been supported among them merely by the influence of Prussia and England. Through hatred to this office, which had now become odious chiefly to the mercantile aristocracy of Holland, they were little attached to their allies, and gave them, during the present war, as little support as possible. The stadtholder and his family now fled to England. The French declared, that they did not mean to make subjects but allies of the Dutch, and invited them to call together popular assemblies for settling their own government, under the protection of the French republic.

Thus terminated a campaign, the most astonishing, perhaps, that has been known in the history of mankind. In the course of it, even before the conquest of Holland, the French had taken 2000 pieces of cannon and 60,000 prisoners. After that event, the conquered territories added to them a population of nearly 14 millions of people. Luxembourg and Mentz were the only places on this side of the Rhine that resisted them. The former was closely blockaded, for the purpose of compelling it to surrender; the latter was several times assaulted, but successfully held out.

3 The et of Rati n esolution eace

At this period Europe seemed to be weary of such a bloody contest, and the Diet of Ratisbon intimated its resolution to adopt such measures as might tend to bring about a general pacification. A treaty was concluded between the grand duke of Tuscany and France. The convention declared their readiness to treat for peace with any of the powers of Europe upon honourable terms. Great Britain and Austria, however, seemed to be persuaded, that an honourable and permanent peace could not be obtained with France, while her government was subject to such perpetual changes. For instance, such was the enmity of the Mountain party against the Gironde, that any treaty entered into by the latter would have been trampled upon by the former: and such, it was observed, might continue to be the aspect of affairs in that distracted country for an indefinite length of time.

France. 1795.

414 A new constitution.

As the constitution which had been framed in the year 1793, during the tyrannical dominion of Robespierre, was justly deemed impracticable, a committee was appointed to frame one entirely new. It was composed of Sieyes, Cambaceres, Merlin of Douay, Thibaudau, Mathieu, Le Sage of Eure and Loire, and Latouche. On the report of Cambaceres, the 19th of April, that the committee thought that a commission should be appointed for this important business, a number of qualified persons were accordingly chosen, while all citizens were invited to communicate their sentiments upon the subject, and the committee was to give orders for the best plans to be published. The feelings of the nation at large received additional gratification from the conduct of the convention towards Fonquier Tainville the president, and 15 judges and jurors, of the revolutionary tribunal. They were fully convicted on the 8th of May, and executed on the 9th, launched into eternity amidst the just execrations of a vast multitude of spectators.

415 Insurrection of the Jacobins.

Although the Jacobins were defeated on the 1st and 2d of April, they did not consider themselves as entirely subdued. They were plotting a more extensive insurrection, which was not to be confined to the capital, and fixed on the 20th of May as the period of revolt. On the morning of that day, the tocsin was accordingly sounded, and drums beat to arms in the suburb of St Antoine, in which the Jacobins had always enjoyed the greatest influence. Upon this the convention met; and although the insurrection was far from being a secret, the committee of public safety did not appear to have taken any measures to prevent it. It was only at the moment when the insurgents were approaching that General Hoche was appointed to the command of the armed force, and sent to collect the military and citizens for the protection of the convention. The hall was presently surrounded, the guards were overpowered, and the mob forced their way into the midst of the assembly. The multitudes of women who met upon this occasion shouted for bread, and the constitution of 1793. Vernier the president, a man far advanced in years, quitted the chair to Boissy d'Anglas, who kept it with commendable fortitude during the remainder of the day. The mob had cockades with this inscription upon them, "Bread, and the constitution of 1793." One of the party attached to the convention imprudently tore off the hat of one of the insurgents whom the multitude attacked with swords; and as he fled towards the chair of the president, he was killed by a musket shot. The majority of the members gradually retired from this scene of lawless intrusion, and left the multitude masters of the hall. Four of the members who remained espoused the cause of the insurgents, whose triumph, however, was of very short continuance. A large body of the military and the peaceable citizens vanquished them in the evening, the powers of the majority were restored, and the four deputies

France. 1795. puties who espoused the cause of the mob were arrested.

416 Mean compliance of the convention. It would appear that the convention and the citizens of Paris now believed their triumph to be complete, as no measures were adopted by them sufficient to prevent the repetition of a similar outrage. The Jacobins, however, were not yet determined to view their cause as desperate, for next day they collected in the suburbs, and in the afternoon made a second attempt. The Carousal was taken by them without opposition, when they pointed some pieces of cannon against the hall of the convention, the members of which being wholly unprotected, endeavoured to gain over the mob by flattery,—by promising them bread, and the constitution of 1793, or whatever else they thought proper to demand; and the president even gave the deputation the fraternal embrace. On the 23d, the citizens assembled, and went to the Thuilleries to defend the convention from insult and violence. The military collected in considerable force; and the convention was at length encouraged to act on the offensive. It was decreed that if the suburb of St Antoine did not immediately surrender its arms and cannon, with the murderer of Ferrand, it would be declared in a state of rebellion. The generals of the convention received orders to reduce it by force; and the insurgents finding themselves unequal to the conflict, were forced by the inhabitants to make an unconditional surrender, to preserve their property from the depredations of the military. The soldiers found among the prisoners were put to death, on which occasion six of the members were tried and condemned by a military commission. Three of them were guilty of suicide, and the other three were publicly executed.

417 Defeat of the Jacobins. In the southern parts of France, the Jacobins were equally turbulent as their brethren in Paris, and formed an insurrection at Toulon on the 20th of May, seizing on the gates, upon which they planted cannon; they set at liberty such of their associates as had been incarcerated, and detained the fleet which was about to put to sea. From Toulon they proceeded to Marseilles, at which time they were 3000 strong, and had 12 pieces of cannon. On their march they were opposed by Generals Charton and Pactod, by whom they were defeated, 300 of them being sent prisoners to Marseilles, and Toulon was liberated.

418 Hope to be successful. The Mountain party, who were anxious to revive the terrific reign and measures of Robespierre, were now very much reduced, and exposed in many places to violent persecution. Associations were formed for the purpose of avenging the crimes they committed during the continuance of their power. When we reflect on the character of Robespierre's government and what all ranks of men suffered under it, we must consider it truly astonishing that any number of men should hazard their lives in attempting its restoration. The party was of course gradually abandoned by its adherents on the fall of its tyrant, and it sunk in the estimation of every one who examined it with attention. Still, however, a small party remained, the members of which were men of superior activity and enterprise. They consisted of ferocious republicans, who thought they beheld the revival of royalty and aristocracy in every attempt to establish a mild, sober, and regular government Yet, amidst the universal odium cast upon them, the Jacobins expected to rise once more into power; but what is most singular, the revival of their strength is to be dated from their unsuccessful insurrection just now mentioned. Their want of popularity began to affect the convention, as the people remembered how tamely that body submitted to the tyranny of Robespierre, of whose power the majority of the members had been the servile instruments. The press, therefore, being now free, the most hideous picture of their conduct was held up to the public. The greater part of them now began to repent of their victory over the Jacobins, as they foresaw that the consequences in the end might prove fatal to themselves.

On the 23d of June, Boissy d'Anglas presented the report of the committee relative to the plan of a new constitution. It was, like its predecessors, prefaced with a declaration of the rights of man, consisting besides of 14 chapters on the following subjects:—the extent of the republican territories, the political state of citizens, primary assemblies, electoral assemblies, the legislature, the judicial authority, the public force, public instruction, the finances, foreign treaties, the mode of revising the constitution, and an act that no rank or superiority should exist among citizens, but what might arise from the exercise of public functions. 419 New constitution.

The legislature was composed of two assemblies, the council of the Ancients, consisting of 250 members, as none but married men and widowers turned of 40 could be chosen members of it; the other council consisted of 500 members, and enjoyed the exclusive privilege of proposing the laws, while the council of Ancients might reject or oppose, without having power to alter the decrees. The executive power was intrusted to five persons who were to be 40 years of age at least, and to be denominated the *Executive Directory*. The two councils had the power of electing its members, the council of five hundred proposing 10 times as many candidates as could be chosen, and the council of two hundred and fifty selected the five members from among these 50 candidates. One member of the directory was to go annually out of office, by which they were all changed in the course of five years. In enacting laws the directory had no vote, being appointed purely to superintend the execution of them, regulated the coining of money, and had the disposal of the armed force. The treaties made by the directory with foreign courts were not binding without the sanction of the legislature, and war could not be made without a decree of the two assemblies. The whole articles of the new constitution underwent a separate discussion, when they were to be transmitted to the primary assemblies for their approbation. Prior to this event, however, it was agreed on by a majority of the convention, in order to avert the danger which now threatened themselves, from the loss of public favour, that at the approaching general election, the electors should be bound to return two-thirds of the present members, and if this failed, that the convention themselves might fill up the vacancies. These decrees accompanied the constitution; but at Paris the idea of re-electing two-thirds of the old members was rejected with contempt, and the absurdity of it pointed out with every expression of acrimony. 420 made up of two assemblies.

The convention, in the mean time, did not fail to publish the approbation of the decrees by the primary assemblies, as well as of the constitution, although it is certain 421 Freedom abridged by the convention.

certain that vast numbers had confounded the two together, and given their approbation accordingly. Such was the rage of many against the convention in consequence of the decrees already mentioned, that it was even proposed to try the whole members before a new revolutionary tribunal, and punish each in proportion to his crimes. The sections remonstrated against the decrees to the convention, and the more eager they appeared in the business, the more persuaded was the convention of its own imminent danger. Every remonstrance, however, was disregarded, and the contending parties formed the resolution of settling it by force of arms. About 100 electors of Paris met in the hall of the theatre in the suburb of St Germain before the day of meeting which had been appointed by the convention, and having chosen De Nivernois for their president, began their debates, absurdly concluding that the sovereignty was vested in the hands of the electors, after these had been chosen by the primary sections. A body of troops was sent to dissolve them as an illegal assembly, which was accomplished without any difficulty, the citizens not having been unanimous in their sentiments respecting it.

22 Ja bins co ed by the nven- tio

This, however, did not prevent the sections from presuming that by steady perseverance they would be finally victorious, having always found that the party favoured by the co-operation of the Parisian populace, had carried their point ever since the commencement of the revolution. The armed force with which the convention was surrounded gave the people very little alarm, as they endeavoured to persuade themselves that the military could never be brought to act against the citizens. As the members of the convention also appeared to suspect their fidelity, they applied for assistance to those very Jacobins whom they had humbled on the 24th of May. If the sections of Paris detested the members for their connexion with the atrocities of Robespierre, the Jacobins admired them from this very circumstance; a set of restless, bloody men, who were never satisfied with wars abroad nor revolutions at home. Hundreds of them were released from prison, and put in a state of requisition for assisting the legislative body.

3 Stru le betw n the nven- tion d Par ans.

The sections of Paris having beheld the convention surrounded by men who had justly obtained the appellations of *terrorists* and *men of blood*, they exhibited a desire of engaging them which was altogether unbounded. Their leader designed to make the members prisoners, till they could be conveniently brought to trial, and in the interim conduct public affairs by committees of the sections, till a new legislative body could be chosen. General Miranda was to have the command of the armed force after the overthrow of the convention, but as it was still problematical which party would be triumphant, he retired to the country till the event should declare it, resolving to have the reward of a conquest to which he was to contribute nothing. The superior officers of the convention were unfaithful, yet the subalterns and soldiers might have continued firm, to which they would, no doubt, be strongly exhorted by their Jacobin auxiliaries. What was greatly in favour of the convention was, that the first moments of enthusiasm were permitted to pass away, after which the sections exhibited a conduct both undecided and weak.

424 Barras appointed to the chief command of the national troops.

Barras was appointed on the 4th of October by the convention to the command of the troops, Generals Menon, Raffet and some others, having been dismissed from office. Barras called in the aid of the most able officers, among whom we find Brune and Bonaparte, and made speedy preparations for a vigorous defence. Troops with cannon were placed in every avenue leading to the Thuilleries, and masked batteries were placed in situations of a more retired nature, if any of these should happen to be forced. The precaution was also taken of transporting the provisions and military stores to St Cloud, if the convention should be obliged to retreat from Paris. On the 5th of October both parties continued on the defensive for several hours, but about three o'clock in the afternoon, overtures were made by the general of the insurgents, Danican, in which he declared that the intention of the citizens was for peace, only they apprehended a massacre was to be begun by the armed terrorists surrounding the convention, and that if these were removed they would return to their duty; but it was resolved to try the issue of the dispute at the point of the sword, as the Jacobin party in the convention were now more fully persuaded of ultimate success. On this occasion the armed Jacobins without are generally understood to have been the first aggressors. The citizens on the south side of the river made an effort to reach the convention by the Quay de Voltaire, but were completely prevented by the cannon of the convention, while the conflict was extremely obstinate on the other side of the river, near the convention. After an engagement of four hours continuance, the sections were repulsed, and driven to the post of St Roche, which being also taken after an obstinate resistance, the insurgents fled to their head quarters at the section of Pelletier; but the troops of the convention were, about midnight, in possession of the whole city.

425 The violent Jacobins again take the lead.

The victors attributed this insurrection to the influence of the royalists; and whether they were right in their judgment or not, it is certain that the cause of royalty was now become less odious to the people in general than the bloody extravagance of republicanism; but the mob in fact seemed to have looked no farther than the disarming of the Jacobins, and obtaining new representatives. The attempt failed, and the Mountain were again at the head of the state. The sittings of the convention were terminated on the 27th of October, and was succeeded by the new legislature in terms of the constitution. Among its last decrees, was one granting a general amnesty for all crimes and proceedings of a revolutionary nature, but the emigrants, transported priests, and every one concerned in the last insurrection, were excluded from the benefit of it. The agents of Robespierre in Paris and the departments were liberated from prison, and promoted to lucrative offices under the new government.

426 Measures of the new legislature.

The next step of the new legislature was to divide itself into two councils, and proceed to the election of an executive directory. The council of five hundred was bound to present to the other council 50 candidates, of which a list was accordingly made out, consisting of no more than five whom they wished to be chosen, the other 45 consisting of obscure persons, farmers and peasants, which left no more power to the council of ancients than the form of an election, which must

France. 1795. must fall on Sieyes, Barras, Rewbell, La Reveillere Lepaux, and Letourneur de la Manche, none of the rest being qualified for the office. The intriguing Sieyes, however, did not deem it prudent to venture on the possession of power; and on his declining to accept of this new dignity, Carnot was appointed in his stead. The form of government now established did not promise to be productive of much happiness or tranquillity, as the most important offices in the state were filled by men whom the people could not endure. The members too of the executive directory, except only Reveillere Lepaux, had always been connected with the Mountain party, and they employed the Jacobins in almost every official department, which could not fail to render the government peculiarly obnoxious. It was feared that a directory chosen by the Jacobins, and new legislators appointed by the people, might one day be the means of totally subverting the constitution, which actually took place.

427 Treaty of peace with Prussia.

On the 10th of April a treaty of peace with the king of Prussia was presented to the convention, in order to be ratified. By virtue of this treaty, it was agreed that the republican troops should be immediately withdrawn from the territories of Prussia on the right bank of the Rhine, having power to retain, till a general peace, the teritories which France then possessed on the left bank of that river. There was to be a mutual exchange of prisoners of war, and the intercourse between the two countries was to be placed in its former situation. Measures were also adopted to shift the theatre of hostilities from the northern parts of Germany. At the same time the king of Sweden acknowledged the French republic, whose ambassador was received at Paris with great solemnity. Another treaty was concluded with Prussia in the month of May, which had a special reference to the line of neutrality. The cantons of Switzerland followed the example of the king of Sweden, and a treaty of peace was concluded at Basle on the 22d of July, between the republic and the court of Spain, in consequence of which France gave up all the conquests she had made in that country, and the original frontier was restored; in return for which the republic received all the Spanish part of St Domingo. In this treaty the Dutch republic was included, and the mediation of the king of Spain, in favour of Portugal and the Italian princes, was accepted by France.

428 Death of Louis XVII.

On the 9th of June, the dauphin, the heir to the throne of the unfortunate Louis XVI. and his only son, died in the prison of the Temple, where he was confined with his sister since the death of the king. Some think that his death was the consequence of disease, although it is much more probable that he was poisoned, since there is no crime in the annals of human depravity which the French rulers would have trembled to perpetrate, of which the numerous murders already detailed afford indubitable evidence. His death, however, interested the French nation so deeply in favour of his barbarously used family, that the convention found it prudent to liberate the princess. The committee of public safety proposed to the emperor to give her up in exchange for the commissioners whom Dumourier had sent prisoners to the Anstrians, together with Semonville and Marat, who were seized on their way to Turkey as envoys extraordinary from the French republic. The proposal was agreed to, and the exchange took place at Basle in Switzerland.

429 Britain superior by sea.

If Britain was unfortunate in her affairs on the continent, she still retained her superiority on the watery element. A fleet under Admiral Hotham engaged a French fleet on the 14th of March, and took two sail of the line, the Ca Ira and Censeur; but this was nearly counterbalanced by the loss of the Berwick and Illustrious. Three French ships of the line were captured by Lord Bridport on the 23d of June, in an attack on the enemy's fleet off Port L'Orient, the rest of the fleet effecting its escape. As Britain thus evinced upon all occasions her superiority by sea, advantage was taken of this circumstance to send assistance to the royalists in the western departments, which unfortunately for them came too late, for the convention had offered them a treaty, which was accepted and signed at Nantz on the 3d of March, on the one part by deputies from the convention, and on the other by Charette, Sapineau, and other chiefs of the insurgents of La Vendée, and by Cormartin, as representatives of the party called *Chouans* or *night owls*. Stofflet submitted to the republic on the 20th of April. The countenance given by Britain to the royalists made them disregard these treaties. The troops sent to their aid were composed of emigrants in the pay of Great Britain, and a number of prisoners who agreed to join the royal cause. Puisaye commanded this motley army, and Count de Sombreuil afterwards joined him with an inconsiderable reinforcement. This expedition arrived in the bay of Quiberon on the 25th of June. Arms were put into the hands of the inhabitants of the country, but it was soon found that they could not be of much advantage to regular troops. A resolution was therefore adopted to withdraw the emigrant army within the peninsula of Quiberon, the fort of which name was taken on the 3d of July, the garrison of which consisted of about 600 men, and was afterwards occupied by the emigrants. All the posts without the peninsula were carried by an army under General Hoche, the emigrants and Chouans escaping into the boats of the British fleet, or flying for protection under the cannon of Quiberon fort. The republicans then began to erect formidable works on the heights of St Barbe, which commanded the entrance of the peninsula. To prevent these operations, a sally on the 7th was made from the fort, but without effect, and another with still greater force had no better success. The whole forces in the peninsula amounted, including Chouans, to about 12,000 men, 5000 of whom were sent to make an attack on the heights of St Barbe, where the republicans were entrenched in three camps, two of which were taken without difficulty; but as the emigrants rushed forward to attack the third, a masked battery was opened upon them with grape shot, in consequence of which a dreadful slaughter ensued, and very few of the emigrants would have effected their escape, had not the fire from the British ships compelled the republicans to abandon the pursuit.

430 Failure of the Quiberon expedition.

It was now evident that a complete and ultimate failure would be the fate of this expedition, and desertion among the emigrants became very frequent, especially those who had been liberated from prison on condition of serving against the republic. The weather was very tempestuous on the evening of the 20th, which induced the emigrants to indulge in a fatal security. The troops of of the republic were conducted in silence along an unguarded quarter of the shore, and surprised one of the posts, where they found the artillerymen asleep. They extinguished the lanthorn which was intended to give the British fleet the alarm, and seized on their matches. Some of the emigrants threw down their arms and joined the republicans, while others maintained an obstinate contest before they surrendered. Count de Sombreuil was taken and put to death, together with the bishop of Dol and his clergy, none being spared but such as pretended that their appearing against the republicans was purely owing to compulsion.

31 Continental affairs.

But to return to the affairs on the continent. The fort of Luxembourg surrendered on the 7th of June, after having been besieged since the preceding campaign, which put the French in possession of the whole left bank of the Rhine, Mentz only excepted, because the Austrians could conveniently supply it with every necessary from the opposite bank of the river. The republicans therefore determined to cross the river, to invest it on every side; but for some time the attempt was delayed, till the result of the Quiberon expedition should be fully known. The passage of the Rhine at Dusseldorf was effected by General Jourdan in the month of August, as commander of what was denominated the army of the Sambre and Meuse. Having driven three Austrian posts before him, he crossed the Maine, and invested Mentz and Cassel, and Pichegru at the same time took possession of Manheim, having crossed the river near that city with the army of the Rhine and Moselle. A strong detachment of this army having driven Marshal Wurmser from an important post, began to plunder, and consequently run into confusion, of which the Austrians took a proper advantage, returned to the charge, and the republicans were vanquished. Jourdan was pursued by Clairfait to Dusseldorf, where the former general made a stand, and Pichegru recrossed the Rhine near Manheim, leaving a garrison in that city of 8000 men, which, after a vigorous siege, surrendered to the Austrians; and the republicans were driven from the vicinity of Mentz. Little more was either lost or won by the contending parties at this time, and they mutually agreed to an armistice of three months.

4.. Treaty with German princes.

The landgrave of Hesse Cassel entered into a treaty of peace with France on the 28th of August, which was agreed to, on condition that he would furnish Britain with no more troops during the war. Peace upon similar terms was granted to the elector of Hanover: and the duke of Wirtemberg and some other princes of the German empire began to treat; but the negotiations were broken off in consequence of the reverse of fortune which the French now experienced.

4.. Absurd conduct of the directory,

The directory, however, still resolved to prosecute the war with vigour, and therefore made vast preparations during the winter for another campaign. The Mountain party being again possessed of power, soon began to discover their restless, turbulent disposition, which could not long submit peaceably to any government whatever, and became disgusted with that very directory which they themselves had established. They were perpetually disturbing the public tranquillity. The people of Paris, after the 5th of October, durst not openly avow their abhorrence of the Jacobins, but it was understood that their wearing green cravats was a token of contempt. This piece of dress was prohibited by the directory as a mark of attachment to royalty. Of this they were soon ashamed, and recalled their edict in a few weeks. In the southern parts of France, the present authority of the Jacobins produced very serious effects. Freron, by whom they had been abandoned after the death of Robespierre, returned to their cause before the 5th of October, and was sent to Toulon with full powers of administration. He dismissed the municipality which had been chosen by the people, restored the Jacobin clubs, and every person whom he suspected he caused to be imprisoned. The directory was alarmed at the numerous complaints which were made from every quarter against the conduct of those turbulent and bloody men, and resolved to obtain the confidence and affections of the people by deserting them entirely. Freron was recalled from Toulon, and more moderate men were made choice of to succeed the restless, sanguinary Jacobins.

434 which takes measures against the Jacobins.

The directory also made a public declaration that its confidence had been abused. The police minister was charged with the removal from Paris of the members of former revolutionary tribunals, and such as were active leaders of the Jacobins. Ten thousand men, called the *legion of police*, who acted against the Parisians on the 5th of October, and were decidedly the favourers of the Jacobins, received orders from the directory and legislative body to join the armies on the frontiers, which orders they refused to obey, but were compelled to submit by the interference of other troops brought from a distant quarter to provide against that event. This led the violent Jacobins to concert a plan for the ruin of the directory and the majority of the councils, who had now abandoned them. But as they were a considerable time in being ready for action, their designs were discovered and completely defeated. The guards were increased on the 10th of May, and bodies of cavalry were stationed round the Luxembourg and Thuilleries. The council of five hundred was informed by the directory, that a terrible plot was ready to burst forth on the ensuing morning. The conspirators, at the ringing of the morning bell, were to proceed in small parties of three or four men each, to the houses of those persons whom they had singled out for destruction. Having murdered these, they were then to unite in one body against the directory, whose guard they conceived themselves qualified to vanquish. The Jacobins in the mean time had nominated a new directory and legislature, from among the most turbulent and abandoned of their own persuasion. Some of the leaders of this conspiracy were arrested, among whom was Drouet the postmaster of Varennes, who stopped the unfortunate Louis on his way to the frontiers, and with him ten others, who were condemned at Vendome, but Drouet made his escape.

435 Moderate party.

These defeats which the Jacobins experienced, and the disgrace into which they were again brought, determined the moderate party in the two councils to attempt to procure the repeal of the concluding decrees of the convention, which had granted them an amnesty, and confirmed the laws against emigrants, excluding their friends from succeeding them. A number of days were employed in the discussion of these topics, but the moderate party gained nothing in favour of the emigrants, and nothing against the Jacobins but this, that such as owed their preservation to the amnesty, should

France. 1796. should not be deemed competent to hold any public office.

436 Deplorable state of the finances. Another matter of no less a serious nature now called for the attention of the republican government, which was the deplorable state of the finances. While the tyrannical usurpation of Robespierre continued, terror supported the credit of the assignats, which joined to the sale of the church lands, and the property of the emigrants, furnished ample resources in the mean time; and no provision was at all thought of for future exigencies. If money was wanted, more assignats were fabricated, and no enquiry was made concerning the public expenditure, as no taxes were demanded from the people. The directory complained to the councils of the great distress under which they laboured, and of the want of sufficient funds to meet the unavoidable expences of the ensuing campaign. A law was in consequence passed on the 25th of March, giving authority to dispose of the remainder of the church lands at the value formerly fixed on them, which was 22 years purchase. A new paper currency, termed *mandats*, was to be received in payment, but government had now lost its credit. These rapidly lost a great part of their value, which increased the demand for national property; and to prevent this, the legislature decreed that one-fourth of every purchase should be paid in cash, which prevented the sale of the national property, and the circulation of *mandats*.

437 National institute established. During their preparations for the approaching campaign, the directory attempted to render themselves popular at home, by the establishment of the *National Institute*, or society of men of letters under the protection of government. Every man of erudition who had escaped the bloody persecution of the Mountain party, was invited to be a member. It was opened on the 4th of April, in the hall of the Louvre, when the ambassadors of Spain, Prussia, Sweden, Denmark, Holland, America, Tuscany, Genoa, and Geneva, were present, and the members of the directory in their robes of state. The president expressed the determination of the executive power to afford every encouragement to the improvement of literature and the arts; and the president of the institute replied that it was the determination of the members to endeavour to give lustre to the republican government by the exercise of their talents, and by publications. The speeches were enthusiastically applauded by 1500 spectators, and the general expectation was, that France was now to enter on a career of glory and prosperity wholly unprecedented.

438 Proposal of peace by Britain. About this time an approach towards a negotiation with France was made on the part of Great Britain, by Mr Wickham, ambassador to the Swiss Cantons; and on the 8th of March, a note was communicated to M. Barthelemy, ambassador from the French republic. It was asked, whether France would be willing to send ministers to a congress to negotiate peace with his Britannic majesty and his allies? Whether France would be inclined to communicate the general grounds on which she would be willing to conclude peace, that his majesty and his allies might consider them in concert? Lastly, whether France would desire to communicate any other mode of accomplishing a peace? Whatever answer should be returned was to be transmitted to the British court; but it was at the same time declared that Mr Wickham had no authority to discuss these subjects. An answer was returned on the 26th of the same month, by Barthelemy in the name of the directory, complaining of the insincerity of the British court, as its ambassador had no authority to negotiate, and that the proposal of a congress made negotiation endless. It stated the wish of the directory to obtain peace, but that no portion of territory would be relinquished, which formed part of the republic by the constitutional decree. To this note no reply was made; but it was complained of to the foreign ministers resident at the court of London, and considered as leaving Britain no other alternative than the prosecution of the war, at once both just and necessary.

439 Royalists in the west subdued. During the winter season, the directory found means to reduce the western departments to proper subjection. The expedition from England had tempted the royalists once more to try their fortune in the field of battle; but after a number of defeats, their leaders Charette and Stofflet were apprehended, and put to death on the 29th of March, which tended to suppress the insurgents in every quarter. Domestic enemies being thus subdued, the republican government was enabled to make the more vigorous exertions on the frontiers. Their military force was divided into three armies; the army of the Sambre and Meuse under Jourdan was principally stationed about Dusseldorf and Coblentz; the army of the Rhine and Moselle, commanded by the celebrated General Moreau, stationed on the Upper Rhine, and from Landau to Treves; and the third army occupied the Italian coast from Nice towards Genoa, the command of which was bestowed on Bonaparte, a native of Corsica, and one of the most extraordinary men that ever lived in any country, as our readers will perceive in the sequel.

440 Bonaparte takes the command of the army of Italy. The army of Italy about this time was 56,000 strong, which Bonaparte, at his arrival, found very ill equipped, and in a state of mutiny for want of pay and necessaries. Wishing them to prepare for immediate action, he addressed them in the following manner: "If we are to be vanquished, we have already too much, and if we conquer, we shall want nothing." He was anticipated by the enemy. The Austrians employed in the defence of Italy under Beaulieu were more numerous than the army of Bonaparte, to which were added 60,000 regular troops belonging to his Sardinian majesty, the militia of the country, and about 2500 Neapolitan cavalry. On the 9th of April the campaign was opened by General Beaulieu, who attacked a post called *Voltri*, in the possession of the republicans, six leagues from Genoa. They defended themselves till the evening, after which they retreated to Savona. Next day Beaulieu succeeded in all his attempts, till he reached Montenotte, the last republican entrenchment, which contained 1500 men. Rampon, their commander, prevailed with them in a moment of enthusiasm, to swear that they would not surrender, in consequence of which they succeeded in arresting the progress of the Austrian general for the remaining part of the day. The right wing of the French army was, during the night, stationed in the rear of the redoubt of Montenotte, under La Harpe, while Bonaparte, Massena, Berthier and Salicetti, advanced by Altara, to take the enemy on their flank and rear. Powerful reinforcements were in the mean time sent to Beaulieu, who, on the morning of the 11th, again made an attack on La Harpe; but the approach of Massena soon made the Austrians and Sardinians

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nians give way on all sides. Two of their generals were wounded, 2500 were made prisoners, and the republicans pursued them beyond Cairo, which, on the following day, fell into their hands.

441 Defiles of Millesimo forced by Angereau.

General Angereau, on the 13th, forced the defiles of Millesimo: and by a rapid movement General Provera was surrounded at the head of 1500 grenadiers; but instead of surrendering, this brave officer forced his way through the enemy, and entrenched himself in the ruins of an old castle at the top of the hill. Angereau, with his artillery, endeavoured to dislodge him; after which he arranged his troops into four columns, and made an attempt to carry Provera's entrenchments by storm, which proved unsuccessful, but the French had two generals killed, and Joubert was wounded. The adverse armies faced each other on the 14th, while a division was left to continue the blockade of Provera. The Austrians made an unsuccessful attack on the republican centre, while Massena turned the left flank of their left wing in the vicinity of Dego, and La Harpe turned the right flank of the same wing. One column kept in check the centre of the Austrians, another attacked the flank of their left wing, and a third column gained its rear. The republicans took 8000 prisoners, and General Provera at last surrendered.

442 Dego retaken by Bonaparte.

General Beaulieu, after he was defeated at Millesimo, made an effort similar to those which have been frequently found to change the fortune of war. With 7000 of his best troops he made an attack upon the village of Dego, where the republicans after their success were indulging in security. He made himself master of the village, and the troops having rallied under Massena, that general employed the greater part of the day in his efforts to retake it. The republicans were three times repulsed, but Bonaparte having arrived in the evening with reinforcements, the post was retaken, and 1400 men were made prisoners. Bonaparte was now, by design, between the Austrian and Sardinian armies, his right wing being secured by the village of Dego against the efforts of Beaulieu, while he could act against the Piedmontese troops with the greater part of his force. Angereau powerfully seconded his exertions, who had opened a communication with the Tanaro, where Serrurier was approaching the town of Ceva, in the vicinity of which there was a Piedmontese entrenched camp of 8000 men. The redoubts covering this camp were, on the 16th, attacked by General Angereau, capturing the greater part of them, on which the Piedmontese evacuated Ceva during the night, and, on the 17th, Serrurier entered it in triumph. Count Colli repulsed Serrurier on the 20th; but Bonaparte, on the 22d, defeated him at Mondovi. The flying army endeavoured to make a stand at Fossano, its wings being at Coni and Cherasci, which latter place was taken by Massena on the 25th, when Fossano was taken by Serrurier, and Alba by Angereau.

443 Armistice with Sardinia.

Prior to these movements, an armistice was requested by Count Colli on the 23d, which General Bonaparte granted, on condition that the fortresses of Coni, Ceva, and Tortona, should be given up to him, with their magazines and artillery, and that he should have permission to cross the Po at Valentia. The armistice was signed on the 29th of April, and a definitive treaty was concluded at Paris on the 17th of May. The conditions, in so far as they concerned his Sardinian majesty, were unquestionably humiliating. The duchy of Savoy was given up to France for ever, as were also the counties of Nice, Jende, and Bretueil. An amnesty was granted to all his subjects who were persecuted for political opinions, and he agreed that the French troops should have free access to Italy through his territory. He was to erect no fortresses on the side of France, to demolish those of Brunette and Susa, and confess that his conduct to the last republican ambassador had been disrespectful.

444 A formal treaty.

The republican army, in the mean time, advanced towards the Po; but Beaulieu was deceived respecting one article of the armistice, which granted permission to Bonaparte to cross that river at Valentia. Concluding that the republican chief seriously intended to cross at this place, he made every possible preparation to oppose him, while Bonaparte hastily penetrated into Lombardy, and on the 7th of May, was 60 miles down the river to Placentia before the enemy could obtain information of his route. He passed the river without difficulty. Six thousand infantry and 2000 cavalry were dispatched by Beaulieu to oppose the passage of Bonaparte across the river when it was too late, by whom they were met and defeated on the following day, at the village of Fombio. As 5000 more advanced to the assistance of these, they were repulsed by La Harpe, at which time that officer was killed. An armistice was granted by General Bonaparte on the 9th to the duke of Parma, on condition that he paid 2,000,000 of French money, and delivered 10,000 quintals of wheat, 5000 quintals of oats, and 2000 oxen for the use of the army. He likewise agreed to give up 20 of his best paintings, to be made choice of by the republicans. This last measure was strongly objected to by several men of literature and artists as soon as it was known; but the directory disregarded every remonstrance, and gave orders for similar stipulations to be inserted in every subsequent treaty.

445 Victory of Lodi.

As General Beaulieu was forced to abandon the Po, he crossed the Adda at Lodi, Pizzighitine, and Cremona, leaving some troops to defend the approaches to Lodi, which were attacked by the advanced guard of the republicans on the 10th, who drove them into the town, and pursued them so rapidly, that there was no time left to break down the bridge over the Adda. Here the Austrians defended the passage with 30 pieces of cannon, and the republican officers, after holding a consultation, were of opinion that the bridge could not be forced. Bonaparte, however, having demanded of his grenadiers whether they were willing to make the attempt, they commended the proposal, on which he formed them into a close column, when they availed themselves of the darkness occasioned by the smoke of the enemy's artillery, and reached the middle of the bridge unperceived, where 700 of them perished by the Austrian cannon: but a number of republican officers flew to the head of the column, urged on the brave soldiers, broke into the Austrian ranks, and made them fly in all directions.

446 And consequences of it.

It appears that nothing more was expected from the campaign of Bonaparte in Italy, than to induce the different princes and states to abandon the coalition against France, which every one of them assisted either with troops, or with money and provisions. He made himself master of Ferarra, Bologna, and Urbino, granting

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to his Holiness and the duke of Modena an armistice on the usual terms, we mean large contributions, paintings, and curiosities. The Neapolitan cabinet was so terrified in consequence of his march into the Roman territory, that it requested a peace; and Bonaparte agreed to an armistice without any of the humiliating conditions demanded from the other states of Italy. He next proceeded to Leghorn, in the neutral state of Tuscany, in order to drive out the English, and confiscate their property. In this manner did he finish the task assigned him, before the commencement of the campaign on the Rhine. It is true that Mantua was still in possession of the Imperial troops; but it was in a state of siege, and the rest of Italy was submissive to the French republic.

447 Success of the French in Germany.

With a view to lessen the exertions of the republicans in Italy, the contest in Germany was renewed by the Austrians. General Jourdan was of consequence informed, that the armistice would terminate, and the war be renewed, on the 31st of May. Jourdan at this time had to contend with General Wartensleben, while the archduke was at the head of the army in the Hundsruck, to oppose General Moreau on the Upper Rhine. A singular stratagem distinguished the commencement of the campaign on the part of the French, with a view to decoy the whole of the Austrian forces to the Lower Rhine, that an opportunity might thus be afforded to General Moreau of suddenly entering Swabia, and carrying the war to the hereditary territories of Austria. Jourdan began to make vigorous exertions, and Moreau remained inactive. The lines of Dusseldorf were left on the 31st of May by the left wing of Jourdan's army, under the command of General Kleber, who defeated the Austrians in marching towards the Sieg. Advancing with his centre and right wing, Jourdan forced the Austrian posts on the Nahe, effected the passage of the Rhine, blockaded Ehrenbreitstein, and hastened forward as if he designed to form the siege of Mentz. These movements brought the archduke into the perilous situation of having Moreau in his front, and Jourdan in his rear. He therefore crossed the river in haste, leaving the fortresses of Mentz and Manheim to retard the progress of Moreau. The archduke attacked the advanced guard of General Jourdan, which, after an obstinate and bloody conflict, he forced to retire. Jourdan, upon this retired to his former positions; and Kleber, on the 20th, entered the lines of Dusseldorf, from which he had taken his departure.

448 Defeat of the archduke Charles.

The archduke had no sooner withdrawn from the Palatinate to force Jourdan down the Rhine, than Moreau marched speedily towards Strasburgh, by which the hostile armies seemed as fast as possible to be flying from each other. The passage of the river opposite to Kehl was effected by Moreau on the 24th of June, which was attended with considerable difficulty, a sudden swell having prevented the Austrians from being taken by surprise, which appears to have been the primary intention of the republican commander. The entrenchments on the islands occupied by troops, were instantly carried at the point of the bayonet, and 2600 republicans effected a landing on the opposite shore, where they were exposed to the Austrian cannon from the camp of Wilstedt, and to the cannon of the fort; still, however, they maintained their ground, and likewise acted on the offensive, till the boats returned with reinforcements, when the fort and redoubts were carried by storm, and the Austrians retreated towards Offenburgh.

449 Austrians defeated by Moreau.

In consequence of the archduke's departure to the Lower Rhine in pursuit of General Jourdan, and the detachments sent to Italy to check the victorious career of Bonaparte, General Moreau was in a situation for entering Swabia with a superior force. On the 26th of June he succeeded in compelling the Austrians to abandon their camp at Wilstedt, and next day proceeded with his army in three columns, against another body of 15,000 men before Offenburgh. A detachment from General Wurmser was sent to their assistance, but these were defeated on their march by two republican columns, and Offenburgh was evacuated during the night. The mountain of Knubis was seized on the 2d of July by a body of French under General Laroche. This is the loftiest point in that ridge of mountains denominated the *Black Forest*. The Austrians were next day driven from the pass of Friedenstadt, after an obstinate resistance, by which their communication with the emigrants under the Prince of Condé was entirely cut off. The Austrians were attacked at Rastadt on the 8th by the left wing of the republican army, commanded by the gallant General Dessaix, and, after a most obstinate resistance, were obliged to retreat to Ettingen.

450 The French enter Frankfort.

The archduke now arrived with his army on the Lower Rhine, leaving Wartensleben to check the progress of General Jourdan, who began to act upon the offensive as soon as the archduke departed. General Kleber, as before, set off from the lines of Dusseldorf, and the centre and right wing crossed the Rhine in the vicinity of Coblentz. The French forced the posts of Ukareth and Altenkirchen, and the whole army under General Jourdan crossed the Lahn on the 9th of July, and next day Wartensleben was defeated with great slaughter, and the loss of 500 men taken prisoners; and the republicans entered Frankfort on the 12th. The two imperial armies were now not far from each other, being in the centre between those of Moreau and Jourdan. Had the archduke found it practicable to resist for a little one of these two armies of the French by a detachment, while he rushed upon the other with the main body of his army, it is not improbable that an end might thus have been put to any further invasion of the Germanic empire; but the activity of the republican officers was not so easily checked, nor could their progress be arrested by any partial exertions. His last resource, therefore, was to give battle to Moreau, which was most obstinately fought on both sides. The French, in their endeavours to force the heights of Rollensolhe, were four times repulsed, and, after a most terrible slaughter, they carried the field at the point of the bayonet.

451 The archduke retreats through Swabia.

In consequence of the loss they sustained at the battle of Ettingen, the two imperial armies retired eastward, the archduke retreating through Swabia towards Ulm, where he had magazines. At every post of any strength he made a stand, in order to obstruct General Moreau's progress as much as possible. Wartensleben, in his retreat through Franconia, made a similar opposition to the march of Jourdan. The archduke was forced by Moreau to cross the Neckar, and afterwards the Danube, by which means the whole circle of Swabia was in the rear of the republicans. Wartensleben was forced to to retreat through Aschaffenbourg, Wartsburg, Schweinfurt; and was obliged to cross the Rednitz, in order to shun the army of Jourdan, which was pressing on his rear. Jourdan continued to advance, till his right wing, commanded by General Bernadotte, was posted at Neumarck, his advanced posts at Teining, and the main body of the army pursued Wartensleben beyond the Nab, having arrived at Amberg on the 22d of August.

452 Great alarm in Germany. The three republican armies commanded by Moreau, Bonaparte, and Jourdan, were possessed of the whole country from the frontiers of Bohemia to the Adriatic, excepting only a part of the mountains of Tyrol, which caused an alarm through the whole of Germany. The payment of 4,000,000 of French money procured a peace for the duke of Wirtemberg; and the circle of Swabia obtained it, on condition of paying 12,000,000 of livres, and delivering 8400 horses, 5000 oxen, 100,000 quintals of wheat, 50,000 quintals of rye, 100,000 sacks of oats, 100,000 pairs of shoes, and a large quantity of hay. Peace was granted to the margrave of Baden upon similar terms. Negotiations were also entered into by the elector of Bavaria and the circle of Franconia, having offered large sums in order to procure it. Even the diet of Ratisbon sent a deputation to the republican generals to treat for a neutrality. Spain made a treaty with France, both offensive and defensive, and war was in consequence soon after declared against Great Britain.

453 The house of Austria in danger. Bonaparte was detained still in Italy, whereas had it been in his power to cross the Tyrol at Inspruck, and reach the Danube, it is more than probable that the emperor of Germany would have been obliged to accept of a peace upon any terms which the conquerors thought proper to propose. He was now abandoned by every member of the coalition, Britain alone excepted, whose pecuniary aid enabled him to extricate himself from the dangers which surrounded him. A command of money raised one army after another to check the career of Bonaparte in Italy, while his German armies were recruited by extensive levies, and mercenary troops belonging to the states which had made peace with France.

454 Able conduct of the archduke. The archduke Charles having received strong reinforcements, came to the resolution of opposing Moreau at Umersheim. A desperate battle was of consequence fought, of 17 hours continuance, when one of the wings of the Austrian army succeeded in gaining about four leagues of territory in the rear of the republican army; but as the archduke was informed that Wartensleben could not maintain his ground against the efforts of General Jourdan, he deemed it prudent to retreat, and adopt new measures. On the 17th of August, he left General La Tour to be a check upon Moreau, and crossing the Danube at Ingolstadt, he marched to the relief of General Wartensleben, and with united forces determined to fall upon Jourdan. On the 23d he made an attack upon Bernadotte at Teining, whom he compelled to retreat towards Nuremberg. The archduke was now on the right of Jourdan, and Wartensleben was in front of him, which induced the French commander to retreat on the 24th. Such was the state of the French finances at the beginning of this campaign, that the armies of Jourdan and Moreau were under the necessity of plundering wherever they came, to supply their immediate wants. This was particularly the case with Jourdan's army, which, when it began to retreat, suffered almost as much from the exasperated inhabitants as from the opposing army. The archduke and Wartensleben having united their forces, the former was enabled to dispatch General Nauendorf with reinforcements to La Tour, to keep Moreau in check, while he continued his pursuit of Jourdan towards Wartzburg, where the French made a stand, and a severe engagement took place on the 3d of September. In this, General Jourdan was the greatest sufferer, and he continued his retreat during the night. Having crossed the Lahn, he made a feeble resistance, and marched along the banks of the Rhine, till his army, on the 17th, arrived at Coblentz and Dusseldorf, from which it had formerly departed.

The army of Moreau was now in a situation extremely perilous, yet he maintained his position till the 17th of September, the very day on which Jourdan reached Dusseldorf; but he was obviously in a wavering condition as to his future movements, and one of the greatest generals Europe ever beheld was now at a loss what step to take. He made an unsuccessful effort to draw the archduke from the pursuit of Jourdan. Many attacks were made upon him, but without effect; and the Austrian generals gave way to him wherever he turned. But finding that the retreat of Jourdan was irretrievable, and that General Bonaparte was still detained in Italy, he finally resolved to retreat. To prepare for this arduous undertaking, he had crossed the Lech, which he suddenly repassed, as if fully determined to penetrate farther into Austria, and compelled La Tour to fall back to Lansberg. Having thus obtained a free passage for his future movements, he began his ever memorable and unexampled retreat, passing between the Danube at Ulm and the lake of Constance, while La Tour continued pressing upon his rear. The passes of the Black Forest were occupied by numerous bodies of Austrians and armed peasantry, while his right flank was harassed by Generals Nauendorf and Petrasch, at the head of 24,000 men. He turned once more upon La Tour with terrible impetuosity, defeated him, and took 5000 prisoners, whom he was able to carry to France. He after this continued his retreat, checking Nauendorf and Petrasch with the right wing of his army under General Dessaix, and the rest of the army cleared the passages in front, till he reached the Valley of Hell, a narrow defile extending for some leagues between lofty mountains, and in particular parts of it not more than a few fathoms broad. This passage was forced by the centre of his army in a mass, and the wings opposed the enemy under Nauendorf and La Tour. After this dreadful effort, he arrived at Fribourg on the 13th of October. The archduke, on his arrival from the pursuit of Jourdan, forced him to abandon his positions on the Swabian side of the Rhine, Kehl excepted, and a temporary fortification at Huningen, called a bridge-head.

455 Moreau's situation highly critical.

456 His unparalleled retreat.

As the French frontier at this time was in a defenceless situation, the Imperial troops took advantage of it to cross the Rhine at Manheim, and march in different detachments to Weissemburg, Seltz, Hagenau, and nearly to the very gates of Strasburgh, levying contributions, and demanding hostages wherever they came. When these detachments were recalled, the 457 French frontier at this time defenceless.

archduke

France. 1796. archduke formed the resolution of terminating the campaign by the reduction of Kehl and the fortification at Huningen, which he found to be no easy task. At both these places a communication was open with the French side of the river, and the divisions of General Moreau's army did duty at them alternately. Much of the winter was spent by the Austrians in endeavouring either to carry them by storm, or to reduce them in consequence of a regular siege. The French at last agreed to evacuate Kehl on the 10th of January, and the fortification at Huningen was surrendered in the month of February.

458 Bonaparte victorious in Italy.

Although the republicans in Germany experienced very considerable reverses of fortune, as we have just now seen, yet Bonaparte in Italy continued victorious. Having laid all Italy under contribution, he enjoyed the means of preserving a secure and steady discipline over a well paid army. The mode of fighting which he adopted in all desperate cases, was that of the close column; the favourite method of Epaminondas and Gustavus Adolphus. The style, too, in which he addressed his army before any great action, was well adapted to inspire them with enthusiasm. His speech to his army when he first entered Lombardy, deserves to be remembered. "Soldiers, you have rushed like a torrent from the summit of the Appenines, you have driven back and dispersed all who opposed your march. Your fathers, your mothers, your wives, your sisters, your sweethearts, rejoice in your success, and boast with pride of being related to you. But remains there nothing more for you to effect? Shall posterity reproach us with having found a Capua in Lombardy? But I already see you rushing to arms; an unmanly repose fatigues you, and the days lost to glory are lost to your felicity. But let the people be tranquil; we are the friends of all nations, and more particularly of the descendants of the Brutuses, the Scipios, and the illustrious personages whom we have chosen as models. To restore the capitol, to replace with honour the statues of the heroes who rendered it renowned, and to rouse the Roman people, become torpid by so many ages of slavery, such will be the fruit of your victories; they will form an epoch to posterity, and you will have the immortal glory of renovating the fairest portion of Europe. The French nation, free and respected by all the world, will give to Europe a glorious peace. You will then return to your homes, and your fellow-citizens, who, when pointing to you, will say, "He was of the army of Italy."

459 Siege of Mantua.

Bonaparte took up the first part of the month of July in commencing a regular siege against Mantua, expecting to be master of that city towards the end of the month. In this, however, he proved too sanguine, for the military efforts of Austria were very great, and the pecuniary aid of Britain was not refused. Twenty thousand troops were sent from the Rhine, besides vast numbers from different quarters, so that he was obliged to raise the siege, and provide for his own safety in the best manner he could. Massena was driven from his post at La Corona on the 29th of July, while 15,000 Austrians drove the republicans from Salo, and next from Brescia, with the whole of the stores and magazines belonging to the army of General Bonaparte. The Imperial troops, however, committed a fatal blunder in their plan of operations, by dividing into two parts an army which, when united, was a match for the enemy, and placing Bonaparte between them. Of this blunder the republican chief was fully aware, and did not fail to take advantage of it. He unexpectedly raised the siege of Mantua, and leaving a small body of troops to check the Austrians, he marched rapidly westward and retook Brescia, with the magazines and hospitals, on the 1st of August. As he had the mass of his army with him, he exceeded his enemies in numbers wherever he attacked them. Forming a large body of his troops into close columns, the Austrians extended their line with the view of surrounding him, being not yet acquainted with his manner of fighting, by which means he penetrated their line in all directions, and threw them into the greatest confusion. He made 4000 prisoners, and took 20 pieces of cannon. A division of them finding Salo in possession of the republicans, wandered about in search of a road, by which to make their escape, when they summoned Lonado to surrender, believing that the bulk of the French army had gone in search of Wurmser to give him battle. This was indeed the case; but Bonaparte was in Lonado with no more than 1200 men. Although this event no doubt gave him much uneasiness, yet with great presence of mind he threatened to destroy their whole division for insulting the French army, by summouing its commander in chief to surrender. The Austrian officers believed that the whole army was in the place, so that by this singular stratagem 4000 men were induced to throw down their arms.

460 Defeat of Wurmser.

Marshal Wurmser was attacked by Bonaparte on the 5th and 6th, and driven from Peschiera and the river Mincio. The Austrians were obliged to quit Verona on the 7th, and again to betake themselves to the mountains of Tyrol; losing in a contest of six days upwards of 20,000 men, but fortunately three-fourths of them were prisoners. The siege of Mantua was again begun by the French, whose works the enemy had destroyed in their absence, and taken 140 pieces of cannon into the city which they had left behind. By this loss, the French could not undertake a regular siege, and General Wurmser was in a condition to attempt the relief of it by the beginning of September. Bonaparte having been apprised of his approach, left troops behind him to carry on the blockade, while he directed his march northward with the main body of his army, drove the Austrians from St Marco and Roveredo to the pass of Calliano, where they made a stand. Here an engagement ensued, in which the Austrians lost 6000 men taken prisoners, and the French entered Trent in triumph. Instead of retiring from the hero who had vanquished him, Wurmser threw himself into Bassano, upon the flank and rear of Bonaparte, and then marched with rapidity towards Mantua. He endeavoured to make a stand at Bassano, but was defeated with the loss of 5000 men taken prisoners. He crossed the Adige at Porto Legnago, and entered Mantua with no more than 8500 men, infantry and cavalry. Great as this veteran's loss was, it had the effect of detaining Bonaparte in Italy, to watch the numerous garrison of Mantua. He expected that its numbers would very soon reduce it by famine to the necessity of capitulating, but in this he found himself disappointed, as the flesh of the 4500 horses which Wurmser carried into it, afforded subsistence to the troops for a long time.

Such

61 Revolt of Corsica from Britain.

Such was the fame of Bonaparte as a general, on account of the victories he obtained over the Austrians, that his countrymen, the Corsicans, discovered an inclination to throw off the British yoke, and be united to France. They became of course, so mutinous, that the viceroy deemed it necessary to evacuate the island, the submission of Italy to the republic having greatly diminished its value. The imperial subjects of Italy, together with the inhabitants of Bologna, Ferrara, and Modena, now began to form themselves into republics, under the patronage of General Bonaparte; they sent deputies to the convention, raised troops, and abolished all orders of nobility.

62 The Austrians partial successful.

The emperor soon after endeavoured to relieve Mantua, by sending another army into Italy, under the command of General Alvinzi, who having crossed the Piava, was met by the republicans, and compelled to repass the river. Davidovich with his division having driven the French down the Adige towards Verona, General Bonaparte found it necessary to concentrate his forces. He therefore left General Vaubois as a check to the progress of Davidovich, and marched in person against General Alvinzi, and was met by the Austrians at the village of Arcole. As this village could not be turned speedily, on account of a canal, the French were obliged to attempt the passage of a narrow bridge in the face of the Austrian fire. Their officers rushed to the head of the column which had undertaken it, but in vain endeavoured to rally them. Angereau advanced to the end of the bridge with a standard; but he was followed by none, when the commander in chief hastened to the bridge and exclaimed, Grenadiers, follow your general! They followed till within 30 yards of the bridge, when they were intimadated by the tremendous fire of the Austrians, and Bonaparte judged it proper to fall back. In the evening General Guieux took the village at the head of 2000 men, but again left the Austrians in possession of it. On the 16th of November a desperate engagement took place in the vicinity of Arcole; and next day the Austrians pressing on the centre of the republican army, were unexpectedly taken on their flank by the left wing of the enemy, which was lying in ambuscade. Bonaparte sent a party of horse and 25 trumpeters round to the rear of the Austrians, who concluded from the terrible noise, that they were surrounded, and fled on all sides in the utmost confusion.

Having driven Alvinzi across the Brenta, Bonaparte returned; the positions of Rivoli and La Corona were resumed, and Davidovich driven back into Tyrol. General Wurmser still defended Mantua during the remaining part of the year; so that nothing farther may be said to have been gained by so many victories, but to consider Bonaparte as their only invincible commander.

46 Negotiations between Britain and France.

During these transactions in the field of battle, Great Britain made a laudable effort to negociate with France. Passports were obtained from the directory, and Lord Malmesbury set out as ambassador to Paris. He began the negotiation with De la Croiz, the minister for foreign affairs; but his lordship soon found that the directory had no serious intention of concluding a treaty with Britain. While the British ministry, as individuals, did not approve of a peace at that time, yet officially they considered it as proper, if it could be obtained upon honourable terms. It was proposed by Lord Malmesbury, that the principle of mutual restitutions should be agreed upon as the basis of the treaty, and the directory wished that the objects should be specified. Lord Malmesbury therefore said, that the French should give up the Austrian Netherlands, for which Britain would give up the foreign settlements belonging to the republic. Many of the Dutch possessions abroad were also to be relinquished, on condition that the authority of the stadtholder should be acknowledged. He was next required to give in the ultimatum of his conditions in 24 hours; and on complaining of this demand, he was informed on the 19th of December, that the directory would agree to no conditions repugnant to the French constitution; and he was informed that his farther residence was unnecessary.

464 Cape of Good Hope taken by the British.

During this year Great Britain maintained her accustomed superiority at sea. The Cape of Good Hope was taken by Admiral Elphinstone on the 16th of September 1795, which the Dutch were extremely anxious to recover, for which purpose they advanced money to the French to fit out a squadron to combine with them in an attempt to reduce it. Seven ships of war were sent to retake the Cape, under the command of Admiral Lucas, but having been caught between two fires, he could not effect his escape, and therefore he surrendered to the British admiral without firing a gun.

465 The French make an unsuccessful attempt on Ireland.

Although Britain was superior by sea, yet an invasion of Ireland was attempted by the French in the end of 1796; but as folly seemed to have concerted the plan, it was of consequence abortive. The whole was committed to one man, General Hoche, without any second to occupy his place in the event of an accident. The disaffected party in Ireland had received no information of their approach, and the fleet was sent towards a part of the country where the people were not very much disposed to receive them. In this expedition 18 sail of the line, 13 frigates, 12 sloops, and transports with 25,000 men, were employed. It was detained for some time when ready for sailing, in consequence of a mutiny. Hoche set sail on the 10th of December, but in working out of Brest, a ship of the line was lost, and some more of them considerably damaged. The frigate which had on board the commander in chief was separated from the fleet by a gale of wind, in consequence of which, when most of the fleet arrived at Bantry Bay, they were without instructions how to proceed. The officers and troops wished to land, but Admiral Bouvet refused to comply. After remaining for some days on the coast, he sailed for France, and reached Brest with part of the fleet on the 31st. General Hoche reached Bantry Bay when it was too late, and consequently could not land. One ship of the line and two frigates foundered at sea, a frigate was captured by the British, and a ship of the line was run ashore, to prevent her from being taken.

466 Advantages gained by the Austrians.

In the beginning of the year 1797, the archduke Charles was still employed in his endeavours to reduce Kehl, and the fortifications opposite to Huningen, Moreau being still his antagonist. General Hoche was appointed to succeed Jourdan on the Rhine, and Bonaparte was still engaged in the siege of Mantua, while powerful efforts were making to recruit the army of Alvinzi. The youth of Vienna were requested to grant their assistance, when 6000 of them volunteered their services

France. 1797. services for Italy. General Alvinzi's army was now 50,000 strong, with which he continued to alarm the republicans in all directions, in order to conceal from them the plan of his future operations. Bonaparte was still at Bologna, to prevent the escape of General Wurmser by that quarter, which he understood, by an intercepted letter, was his design. Having been informed of the approach of the Austrian army, he hastened to Mantua, and from that city to Verona, where the centre of his line was opposed to Alvinzi; but as the Austrians continued to attack all quarters at once, he could not penetrate the design of their commander. On the 14th of January the movements of the enemy became more serious on the lower part of his line near Porto Legnago; but in the evening being informed that the upper extremity of it under Joubert, had been attacked by vastly superior numbers, there he concluded that the Austrians were in greatest force. Still the Austrians persisted in the absurd plan of dividing their army—an absurdity which melancholy experience had not taught them to correct. Ten thousand troops, including the Vienna volunteers, received orders to proceed to Mantua by Porto Legnago, at the lower end of the republican line, while Alvinzi in person advanced against Joubert, who was forced to retreat, and was reduced to such a situation, that the capture of his whole division on the following day (the 14th) seemed highly probable.

467 They are defeated. Bonaparte having received information respecting the state of affairs, left Verona on the 13th, having ordered Massena to follow him with the centre to Rivoli as fast as possible. On the 14th, at the break of day, the division of Joubert made an attack on the Austrians, at which they were very much surprised, not knowing that Bonaparte had arrived with reinforcements. The superior numbers of the Austrians defeated all the endeavours of the French troops to turn their divisions; and the two wings of the republican army were driven back upon the centre in considerable confusion. Alvinzi engaged the centre, which with difficulty maintained its ground; and the Austrian wings advancing on both sides, entirely surrounded the French. The victory seemed already won, and it is even reported that General Alvinzi sent a courier to Vienna, to announce the approaching capture of Bonaparte and all his army. There can be no doubt that the republican chief was now greatly alarmed, yet he still considered it in his power to make a last effort. Forming three strong columns, he dispatched them against the right wing of the Austrians, which they penetrated at various points, and made it fly in such confusion, that, having met a party of republicans which had not arrived in time to join the army, 4000 Austrians laid down their arms, and surrendered themselves prisoners of war. Bonaparte apprehending that this part of his line was no longer in danger, left Joubert to prosecute the victory, and went to oppose the march of Provera. A party under General Murat having continued their march all the night of the 14th after the battle, seized on Montebaldo in the rear of the position at Corona, to which part of the Austrians retreated, while Joubert on the following morning attacked them in front. Being thus surrounded, they were thrown into confusion, 6000 of them were taken prisoners. and numbers perished in attempting to cross the Adige.

During this bloody conflict on the upper part of the river, General Provera forced his passage across the lower part of it near Porto Legnago, and obliged the republican general Guieux to retreat to Ronco. As Provera was marching rapidly to Mantua, General Angereau came up with his rear, and made 2000 prisoners; but the Austrian general reached the neighbourhood of that city on the 15th, which was blockaded at St George and La Favourite. He summoned the republican commander here to surrender, but he having refused to comply, Provera endeavoured, without success, to carry it by assault. He next made an attack upon La Favourite, and was seconded by Wurmser with the troops in the garrison, who had perceived his arrival; but as Bonaparte had arrived with reinforcements, General Wurmser was defeated, and Provera being surrounded by the French, surrendered himself and his troops as prisoners of war. In consequence of these engagements at Rivoli and Mantua, the Austrians lost 23,000 men taken prisoners, and 60 pieces of cannon. The surrender of Mantua was now inevitable, on account of absolute famine, and therefore it capitulated on the 2d of February. That Bonaparte might allow the French emigrants to escape, he allowed General Wurmser to select and take out of the garrison 700 men who were not to be examined, nor viewed as prisoners of war, and the general himself was to depart unconditionally. 468 Surrender of Mantua.

469 The pope's forces subdued. The most active and vigorous preparations were making by the emperor and the French, for recommencing their bloody contest on the German frontiers, and therefore it was of importance for Bonaparte to leave Italy in his rear in a state of tranquillity. He sent General Victor on the 1st of February, together with the *Lombard legion*, to enter the papal territories; and after the surrender of Mantua, General Bonaparte followed in person. The Lombard legion, after storming the entrenchments of the Pope's troops, made 1000 of them prisoners, and took all their cannon. General Colli had carried away most of the treasure from the chapel at Loretto; but the republicans still found articles of gold and silver worth a million of livres, and the image of the virgin was sent to Paris as a curiosity. At Tolentino the republican chief was met by a messenger from the pope with an overture of peace, and a treaty was concluded on the 19th. The pope promised to pay 15,000,000 of livres, and to deliver 800 cavalry horses, with a like number of draught horses and oxen. He also agreed to pay 300,000 livres to the family of the French ambassador Basseville, whom the rabble had murdered at Rome, and to make an apology by his minister at Paris for that event.

470 Reinforcements sent to Bonaparte. The French having been so unfortunate in their invasion of Germany by the way of Swabia and Franconia, now determined to make their principal attempt from Italy under the command of General Bonaparte. Vast bodies of troops were therefore detached by the directory from those who had served under Moreau, and sent as secretly as possible towards Italy by the way of Savoy. The impending danger was however perceived by the court of Vienna, and therefore gave the command on the side of Italy to the archduke Charles, he being the only Austrian who had hitherto been successful against the republicans. The war was now about to be carried into new territories, where a foe

foe had scarcely ever been seen by the house of Austria. It was necessary that Bonaparte should once more force his way over the Alps, that immense chain of mountains which rises in the neighbourhood of Toulon, and stretching northward, obtains the names of Piedmont and Savoy. It then takes an easterly direction, forming the countries of Switzerland, Tyrol, Carinthia, and Carniola. The three last of these passing along the Adriatic, constitute the frontier, in this quarter, of the hereditary states of Austria. The fertile and level country, which belonged to Venice, lies between the mountains and the sea. It is crossed by many streams which are increased by the melting snows of the Alps, and whose peculiar characteristic is this, that they are greatest in summer, and least in winter.

471 Error of the court of Vienna.

The archduke, instead of making a stand in the defiles of the mountains, was sent into the plain to guard the passages of the rivers; a very important blunder which entered into the plan of defence adopted by the council of war at Vienna.

472 Progress of Bonaparte's army.

While Bonaparte continued to advance to the territories of the pope, the arrangement of the Austrian army was going forward along the eastern bank of the Piava. The republicans were on the opposite side, and Bonaparte, after quitting the papal territories, hastened to join them. Having effected the passage of the Piava on the 12th of March, the Austrians retired, skirmishing for some days, till they crossed the Tagliamento, where they halted with their whole force. The republican army reached, on the 17th, Valvesone, on the opposite side of the river, which after some hesitation they determined to cross. The stream having been diminished by the frost, the French crossed it in columns at different points. Joubert with the left wing received orders to pass along the valley of the river Drave, beyond the highest chain of the *Noric Alps*. Massena, at the head of the centre division, passed into the defiles of these mountains, and the right division, commanded by Bonaparte, marched along the coast of the Adriatic.

473 Surrender of Gradisca.

On the 19th, the town of Gradisca, on the river Lisonza, surrendered to the right wing of the army; and its garrison, consisting of 3000 men, were made prisoners. The same division entered Goritz on the 21st, where it found the principal magazines and hospitals belonging to the Austrians. Trieste was taken on the 23d, and materials worth 2,000,000 of livres were sent off by the French from the quicksilver mines of Ydria. On the 24th a large body of Austrians was confined by Massena, and a part of the right wing commanded by General Guieux; but they having procured reinforcements from the archduke, engaged the French next day, and were defeated, having lost 5000 prisoners and 400 baggage waggons. Equal success attended the left wing under Joubert, Baraguay D' Hilliers, and Delmas. Four thousand Austrians were taken on the banks of the Lavis, and they were defeated at Clauzen, with the loss of 1500 prisoners. This division then directed its march eastward, along the valley of the Drave, towards Clagenfurt, the metropolis of Carinthia, where it was met by General Massena, that officer having obliged the archduke to evacuate his head-quarters, and proceed nearer to the capital of the empire, which now began to be in danger. In 15 days General Bonaparte took 20,000 prisoners, and effected the passage of the Alps, after which there was no place of sufficient strength to arrest his progress to Vienna. Yet it must be confessed that his own situation was not free from danger, and therefore he prudently embraced this moment of unprecedented success to make overtures of peace. He wrote to the archduke on the 31st of March, deprecating the continuance of the war, and entreating him to use his influence for putting a period to its ravages. This prince evasively replied, that it did not belong to him to investigate the principles on which the war was carried on, and that he had no power to negotiate.

474 Partial success of the Austrians.

The Austrians raised the peasantry in the Tyrol, to harass the rear of the French army, by which they gained some advantages under General Laudohn, and drove out the republican troops which had been left at Botzen and Brixen. The people of the Venetian states acted a similar part against the troops left in them, and with the assistance of 10 Sclavonian regiments, they murdered every Frenchman they could find, not sparing even the sick in the hospitals, of whom 500 were massacred at Verona. The Austrians attempted to surround the invading army; but Bonaparte knew that the embarrassment of the court of Vienna was at least equal to his own. He was at the head of 95,000 men, hitherto irresistible; and the Austrians could not but know that to surround his army was not to vanquish it, on which account he persisted in advancing. On the 2d of April, after a bloody conflict, he forced the strong defiles between Freisach and Newmark, making 600 prisoners. His advanced guard reached Hunsmark on the 4th, where they again defeated the Austrians, which induced the cabinet of Austria to treat for peace, there being no place where the army of the archduke could make a stand, till it came to the mountains in the neighbourhood of Vienna. Bellegarde and Morveld requested a suspension of hostilities from Bonaparte, while care was taken to remove the public treasure and effects into Hungary. The French commander consented, on condition of getting possession of Gratz and Leoben, about 50 miles from Vienna. This was on the 7th of April, and the armistice, which was to expire on the 13th, was afterwards renewed for a longer period. A preliminary treaty followed this on the 19th, by which the French were to retain the Austrian Netherlands, and the republic of Lombardy should be called the Cisalpine republic, comprehending the Milanese, Mantua, Modena, Ferrara, and Bologna. Bonaparte consented to return to Italy, if his army should be supplied with provisions during its march, and all farther disputes were to be settled by a definitive treaty of peace. He brought an accusation against the Venetian government for conniving at the murder of the French during his absence, and having possessed himself of the city and territories, he dissolved that ancient aristocracy.

475 Peace concluded between France and Austria.

During the approach of Bonaparte towards Vienna, the republican armies on the Rhine were pressing on the Austrians, that they might not have it in their power to send reinforcements against him. An armistice was offered by the Austrians, but since the French required Ehrenbreitstein as a compensation, both parties resolved to prosecute the war. The left wing of the army of General Hoche proceeded from Dusseldorf, while the centre and right wing crossed the river near Coblentz. On the 18th of April a fierce contest took place between

France. 1797. tween the hostile armies near the Lahn, in which the Austrians lost 4000 taken prisoners. General Moreau having forced the passage of the Upper Rhine near Strasburg, attacked and carried the village of Diersheim. Next day the conflict was renewed with such vigour on the part of the republicans, that the fort of Kehl was taken, and 5000 Austrians were made prisoners. They were next pursued towards the Danube, when all military operations were instantly suspended by messengers dispatched through Germany from the archduke and Bonaparte, with the joyful news that peace was concluded. On the arrival of these messengers, the army of General Hoche was making a desperate attack upon Francfort on the Maine, which General Warnecht was employing every effort to protect. Both armies suddenly received the news, the hostile troops threw down their arms, and congratulated each other on the happy event.

476 Changes in the directory.

A contest of an alarming nature was now fast approaching between the legislative and executive branches of the French government. A third part of the legislative body was now to be changed. On the 19th of May, Letourneur went out of the directory by lot; on the 20th, the new third took their seats, and on the 21st Barthelemy was chosen a member of the directory in the room of Letourneur. Pichegru, Jourdan, and Willot, were among the members of the new third, so that a decided majority of both councils was of the moderate party; and two members of the directory, Carnot and Barthelemy, were understood to be men of the same description. Every measure was adopted which tended to render the Mountain party odious, or embarrass the directory.

477 New plan of finanee;

Gilbert Desmolicres, on the 14th of June, brought up a report from a committee on the state of the finances, in which he inveighed against the prodigality and profusion of the directory and its agents in the strongest language. A new plan of finance was proposed by the same committee on the 18th, which went to take from the directory the administration of the public money. On the preceding day Camille Jourdan presented a report of great length on the subject of religion, wherein he insisted on the impropriety of forbidding its ceremonies to be publicly displayed, and the iniquitous nature of that persecution which its ministers had suffered, because they could not take the oaths prescribed by the legislature. The council of five hundred decreed, on the 15th of July, that all the laws against refractory priests should be repealed; and on the following day a decree requiring from them an oath of fidelity to the constitution, was carried by a majority of no more than six members. Emery, a new member, proposed the repeal of those laws by which the property of emigrants had been confiscated, and that their relations should be considered as competent to succeed them. Such as had fled into foreign countries from Toulon and other parts of the nation, received encouragement to return home, and allowed to cherish the expectation that their names would be expunged from the list of emigrants.

478 and lenient measures in favour of the priests.

479 The royalists assume fresh courage.

The discussion which these topics underwent made the directory and the councils professed enemies to each other. The latter wished the former to be changed before the expiration of the legal time, and the directory wished to deprive many new members of their seats who had been elected by the people. As Barras was rather the most odious member of the directory, an effort was made to deprive him of his seat, under the pretence that he was less than the legal age of 40; but his colleagues maintained that he was born in the year 1755, and it seems no proof of the contrary could be produced. Still the directory did not want a number of adherents. The resolution of the councils in favour of the priests had the appearance of a counter-revolution, which induced the royalists to resume conrage, and journals were rapidly published in defence of their cause. The councils received information on the 20th of July, that a division of the army under General Hoche was within a few leagues of Paris, while the constitution declared that the directory incurred the penalty of ten years imprisonment, if it brought any troops nearer the residence of the legislative body than twelve leagues without its consent. An explanation was demanded, when the directory declared their ignorance of the march, having been undertaken without any orders from them, and purely owing to a mistake of the officer by whom it was conducted: bnt the councils paid little regard to such an allegation. The mutinous suburb of St Antoine adhered to the majority of the directory, which encouraged them so much, that they lost no time in proceeding to action. General Angereau had been sent for from Italy, under the pretext of delivering to the directory some standards taken from the enemy. The Thuilleries was surrounded by Angereau on the morning of the 4th, with a division of the troops, when the guard of the councils refused to act against them, and Ramel their commander was made prisoner. On entering the hall, he found Pichegru and twelve more of the chiefs of the opposite faction, whom he immediately sent prisoners to the Temple. Carnot made his escape on the preceding evening, but Barthelemy remained and was put under arrest. When several members of the councils came to the hall at the usual hour, they were astonished to find that seals had been put upon the doors, and that they could not find admittance. They were ordered to go to the surgeons hall, where the directory, it was said, had appointed them to meet. Of both councils not more than 120 members assembled, who sent to obtain from the directory an account of the late proceedings. They were given to understand that what had been done was absolutely necessary for the salvation of the republic, congratulating the duped councils *on their escape* from the machinations of the royalists. According to the report of Boullay de la Meurth, a vast royalist conspiracy, the centre of which was in the bosom of the councils, was endeavouring to subvert the constitution, but that the indefatigable diligence and activity of the directory had defeated all their attempts! It was proposed to transport the conspirators without a trial, and the councils were so completely imposed upon as to vote the transportation of 53 of their own members, and twelve other persons, among which number were included the directors Carnot and Barthelemy.

During the whole of these transactions the city of Paris remained in a state of tranquillity. Its unfortunate struggle on the 5th of October had so completely subdued the ardour of the inhabitants, that they allowed the national representation to be violated with impunity, and liberty to be trampled under foot, without a single exertion in its defence. The directory excused

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cused their conduct to the nation under pretence of the existence of a royalist conspiracy. General Pichegru, it was said, had offered to join the emigrants under the prince of Condé, and the Austrians commanded by General Wurmser, and with this aggregate force to march directly to Paris, for the re-establishment of royalty. There are certain circumstances which lead us to suspect that this was a fabrication: for at the time when this supposed correspondence became public, it was denied to be genuine; and Moreau, who was implicated in this conspiracy, was afterwards employed in the service of the republic, to whose military skill and fidelity the French rulers seemed willing to commit the salvation of the country.

480 Treaty of Campo Formio.

The directory was now very powerful, but its members soon became giddy from the elevated nature of their situation, and seemed to act under the dangerous conviction, that there was nothing in which they might not venture to engage, whatever might be the rapacity or ambition attached to it. While contending with the councils, they prolonged the negotiations with Lord Malmesbury, acting in a similar manner respecting those which had been entered into between Bonaparte and the imperial ambassadors at Campo Formio. Great Britain offered to make peace with France, if permitted to retain possession of the Cape of Good Hope, together with the Spanish island of Trinidad. The negotiations with the emperor were speedily terminated, and on the 17th of October a definitive treaty was signed at Campo Formio. The Netherlands were given up to the republic, the Milanese to the Cisalpine republic, and his territories in the Brisgaw to the duke of Modena, to compensate for the loss of his duchy in Italy. It was likewise agreed by the emperor that the French should possess the Venetian islands in the Levant, namely Corfu, Zante, Cephalonia, Santa Maura, Cerigo and others. The emperor was to have the city of Venice with its remaining territory, from the extremity of Dalmatia, as far as the Adige and the lake Garda. The Austrians accordingly left the Rhine, by which means the republicans were enabled to surround Mentz and Ehrenbreitstein, the former of which was captured in a short time, but the latter required a very tedious blockade before it would surrender. Venice was at the same time entered by the Austrians, the French having left it, and Bonaparte, when about to march out of Italy, left 23,000 men to garrison Mantua, Brescia, Milan, and some other places, and to preserve this new republic in a state of dependence upon France.

It is said that the directory about this time endeavoured to force America to purchase a forbearance from war by a large sum of money, together with a private present of 50,000l. to the members of the directory. The last part of this charge was denied by the minister Talleyrand, but the general impression it produced could not be effaced, and the directory was thus very much injured in the estimation of such countries as were otherwise disposed to view it in a very favourable light. To lessen its reputation still more, it caused the councils to pass two laws, by which all neutral ships on their way to Britain, or returning from it, should be liable to be seized. This, however, produced an effect very different from that which was intended; for having put all the trade of the western world into the power of the British, they enriched the very people whom they were meant to ruin. Britain at this time held the empire of the seas in such an eminent, and perhaps we may add, unprecedented degree, that the republican fleets lay blockaded in their own ports during the greater part of the year.

France. 1798.

481 A body of French troops land in Wales.

The expedition against Ireland having completely failed, the directory was at a loss how to dispose of the galley slaves who had made a part of Hoche's army destined against Ireland. It would have been cruel to remand them back to punishment; the troops would not serve with them in the army, and by the new laws of France they could not receive a pardon, neither was it prudent to give so many criminals liberty. Thus perplexed, the directory at last determined to send them over to England. They were landed from two frigates and some small vessels on the coast of Wales, with muskets and ammunition, but destitute of artillery. On the evening of the day on which they landed (23d of February), they were made prisoners of war by a party of militia, yeomanry, cavalry, colliers and others, under the command of Lord Cawdor.

482 Defeat of a Spanish fleet by Sir John Jervis.

Although the navy of France continued in port, and therefore out of danger, for the remainder of this year, yet the Dutch and Spanish allies of that country sustained very serious losses by sea. A Spanish fleet of 27 sail of the line, opposed to a British fleet of only 15 sail, under the gallant admiral Sir John Jervis, was completely defeated on the 14th of February, off Cape St Vincent. The British admiral passed twice through the enemy's line, and cut off part of their fleet from the rest. Four ships were taken, and the admiral's own ship made her escape with considerable difficulty. This fleet was on its way to Brest in order to effect a junction with the French fleet, but Jervis's victory rendered this object unattainable. In consequence of this memorable victory, Sir John was created earl St Vincent, and had an annuity of 2000l. settled upon him, receiving at the same time the thanks of both houses of parliament.

483 A Dutch fleet defeated by Admiral Duncan off Camperdown.

The Dutch, if possible, were still more unfortunate, Admiral Duncan having blocked up the Texel where their fleet lay, during the whole summer, with the assistance of which it appears that the French meant to try the fate of another attack upon Ireland. A resolution having at length been adopted of risking an engagement with the British at sea, De Winter received positive orders to sail, a step against which he remonstrated, but without effect. Admiral Duncan was at this time refitting at Yarmouth, but on receiving intelligence of the sailing of the Dutch fleet, he set out in search of, and came up with it on the 11th of October, consisting of a force rather inferior to his own fleet, which amounted to 16 sail of the line and three frigates. The British admiral run his fleet immediately through the Dutch line, commencing the attack between them and their own coast, about nine miles from Camperdown. As the Dutch are desperate fighters by sea, our readers will naturally conclude that this was a sanguinary conflict. It lasted for three hours, at which time the greater part of the Dutch fleet had struck; but owing to the shallowness of the water on the coast they could not all be seized. Eight ships of the line, two of 56 and one of 44 guns, were taken, besides a frigate afterwards lost near the coast of Britain. Admiral De Winter was captured with his ship, and

France. 1798.

Vice-admiral Rentjies. Admiral Duncan received honours similar to those which were bestowed upon Earl St Vincent, and an annuity to the same amount.

484 Great disturbances at Rome.

After the ratification of the treaty with the emperor at Campo Formio, Joseph Bonaparte, one of the brothers of the general, was sent to the city of Rome as plenipotentiary from the French republic. The pope having now no expectation of foreign assistance, submitted to every demand for the reduction of his troops, and for emancipating every person confined in prison on account of their political sentiments. On the 26th of December 1797, three men waited upon the ambassador, and requested the co-operation of France in bringing about a revolution which a party at Rome was anxious to establish. He rejected the proposal, and did every thing in his power to dissuade them from it; but he neglected to communicate the intelligence to the papal government, which was certainly his duty. He went to the secretary of state on the 28th, and shewed him a list of persons under his protection who had a legal authority to wear the French cockade, and consented at the same time that all others wearing it should be punished. He offered to give up six of the insurgents who had taken refuge in the palace. In the evening of the 28th a more serious tumult happened in the courts and vicinity of the French ambassador's palace, with which the pope, it is believed, was not personally acquainted; but the governor of the city endeavoured to disperse the insurgents by parties of cavalry and infantry. General Duphot, in attempting to make the military desist from firing upon the insurgents, was shot by a petty officer belonging to the troops of his holiness. The ambassador and his other friends now made their escape to the palace through a bye-way. The Spanish ambassador having been informed of this event, sent to the secretary of state, and protested against such a daring violation of the privileges of plenipotentiaries. The palace of the French ambassador was still surrounded by the military, when at last he demanded passports to enable him to leave the territories of the pope, which were soon granted, and accompanied by many protestations of the innocence of government, and its sorrow that such an unfortunate event should have taken place.

485 The continental powers decline assisting the pope.

Joseph Bonaparte went to Florence and from thence to Paris. The protection of Vienna, Spain, Naples, and Tuscany, was earnestly solicited by the pope, but they all seemed disposed to keep at a distance from his misfortunes. General Berthier experienced little or no opposition on his march to Rome, where he subverted the dominion of the pope, and proclaimed the sovereignty of the Roman people, with too many marks of wanton, unprovoked insult. The tree of liberty was planted on the very day on which the anniversary of the pope's election to the sovereignty was celebrated; intended, no doubt, to make him feel still greater mortification. While in the Sistine chapel, receiving the congratulations of the cardinals, the commissioner general, and Cervoni, who commanded the troops within the city, during this ceremony entered the chapel, and announced to the sovereign pontiff on his throne, that his reign was at an end. He was removed to the territory of Tuscany, where he dwelt in great obscurity, till his enemies being in their turn driven from Rome, were pleased to remove him farther from the capital, to terminate his existence beyond the Alps.

The greatest curiosities found in Rome were conveyed to Paris, and sold by public auction, the directory having sacrificed national vanity at the shrine of avarice. Passports were offered to the natives of countries at war with France, if they inclined to become purchasers.

486 Conquest of Switzerland resolved on by the French.

But scenes of a different and sanguinary nature were in the mean time exhibited in Switzerland, a country which had preserved its neutrality during the conflict of France with the combined powers, thus defending the weakest part of her frontiers; and as a grateful return for past favours, it was now determined to subjugate Switzerland. About the end of the year 1797, an insurrection broke out in the Pays de Vaud, subject to the canton of Berne, which made the government perceive its critical situation, and issue a proclamation on the 5th of January 1798, requiring the people of the Pays de Vaud to appear in arms, renew their oath of allegiance, and reform every existing abuse. A commission of the senate at Berne was empowered to examine every complaint, and redress every grievance; but their motions were considered as too tardy by popular impatience, and the insurgents endeavoured to become masters of the strong places. Troops were sent against them by the government of Berne, but General Weiss acted with hesitation, if not even with treachery, and a body of republicans appeared under General Menard, who sent an aid-de-camp and two hussars to General Weiss. As the messengers returned, one of the hussars was killed, most probably by accident, but it was instantly magnified into a horrid breach of the law of nations. The French, therefore, continued to advance, and were masters of the whole Pays de Vaud by the end of January. The government of Berne prepared for war, while it at the same time used every effort in order to maintain peace. A truce was entered into with General Brune, the successor of Menard, and those who killed the hussar were delivered up. An army of 20,000 men was collected, the command of which was given to M. d'Erlach, once a field marshal in the service of France. But there was a prevailing disaffection in his army, and the people were far from being united among themselves. With this circumstance the French were well acquainted, and therefore they demanded a total change of government. As M. d'Erlach was apprehensive of a still greater defection in his army, he requested permission to put an end to the armistice. The French now refused to negotiate, and General Schawenberg on the 2d of March took possession of Soleure at the head of 13,000 men. Brune afterwards made himself master of Friburg, and forced the Swiss army to retreat. The government of Berne being now greatly alarmed, decreed the *landsthurm*, or rising of the people in a mass, which their ancient customs justified in the time of necessity. The people assembled, dissolved the government, and offered to dismiss the army, if the republican troops would retire. This offer was rejected, without admitting a French garrison into Berne, and therefore they continued to advance. About 6000 from the army of M. d'Erlach had deserted, leaving him at the head of no more than 14,000 men; and although the rising had abundantly supplied him with numbers, yet he had not time sufficient to get them properly arranged. He was attacked on the 5th of March, and driven from Newenbeg and Favenbrun,

Favenbrun, but having rallied his troops, he made a stand for some time at Uteren. The conflict was renewed at Grauholtz, from whence they were driven four miles nearer the capital. Being completely defeated, they murdered many of their officers in a fit of despair, among whom was their commander in chief. Berne capitulated to the French, which induced the more wealthy and populous states to follow the example; but the poorer cantons made a dreadful effort to preserve their small possessions, and the independence of their country. They compelled Schawenberg to retire with the loss of 3000 men, but were at last totally vanquished by the superior skill and numbers of the republican army. The public magazines were plundered, and a new constitution was forced upon them after the model of France.

If the directory made no scruple to violate the independence of other nations, it was very reasonable to conclude that they would pay little regard to the liberties of their countrymen at home. A third of the legislature was changed in the month of April; one member of the directory went out by ballot, and Treilhard was chosen to succeed him. Nothing was left unattempted by the directory to influence the election in favour of their friends, but their success was not great. They complained to the council of five hundred on the 2d of May; they complained of plots of royaltsts, by which it was said that elections had been made to fall on men who were inimical to the interest of the republic. It was proposed on the 7th by the committee who reported on the message of the directory, that many electoral assemblies should be annulled; but General Jourdan opposed this plan as incompatible with the freedom of election, and as proceeding upon the supposition of conspiracies which had no existence.

7 The extravagant Egyptian project by the directory.

We are now to be presented with the most extravagant project which perhaps the directory ever attempted to execute;—to send a formidable army to take possession of Egypt, and from thence to proceed by the Red sea to the East Indies, to take possession of the British settlements in that quarter of the globe. After peace was proclaimed between France and Germany, the directory made no secret of their determination to invade Great Britain. Whether this project was of Bonaparte's own devising, or intended as a snare in order to get rid of him and his victorious army, seems to be a matter which our readers must be left to determine for themselves. It might not be his project, and he might accept the command of the army of Egypt from this conviction, that he would be safer abroad in the most perilous undertaking, than be exposed at home to the malice of a government become jealous of his reputation, and which was far from being scrupulous of its conduct.

The meditated attack upon Egypt was certainly conducted with such a degree of secrecy as was calculated to mislead. Prodigious stories were circulated concerning rafts of timber, by means of which the *army of England*, as it was called, was to be conveyed over to Britain; and to give the greater probability to this report, General Bonaparte, the commander in chief, made a journey to the western coast. The fleet was getting ready in the harbour of Toulon, and troops were collected in its vicinity. But Bonaparte embarked with 40,000 of his veteran troops, and on the 9th of June reached the island of Malta. He quarrelled with the grand master, because he would not permit so large a fleet to water all at once in his ports. The French commander landed his troops in different places, and attempted to make himself master of the island. It is said that many of the knights belonged to the illuminati, and were therefore ready to betray their government. After a very feeble opposition the grand-master capitulated, and thus gave up in a few days a fortress which, it is said, might have held out for weeks against all the troops of the French republic. Bonaparte left in the island a garrison of 4000 men, and sailed for Alexandria on the 21st.

488 Admiral Nelson goes in search of Bonaparte.

Rear-admiral Nelson having distinguished himself in a very eminent degree, while in the station of commodore under Lord St Vincent, was sent in pursuit of Bonaparte. Being wholly ignorant of the destination of the French, he sailed for Naples, where he obtained information of the attack upon Malta, to which accordingly he steered his course. On his arrival, however, he found that Bonaparte was gone; but conjecturing that he had sailed for Alexandria, he immediately prepared to follow him. The French commander, instead of keeping a direct course towards that city, stood along the Grecian coast, till he made the easternmost point of the island of Candia. Then steering to the southward, he so protracted his voyage, that he did not reach the Egyptian coast till Admiral Nelson had left it. Having landed his troops he took the city of Alexandria by storm on the 5th of July. It was desperately defended by the inhabitants, but without military skill. The republican transports were drawn up within the inner harbour of Alexandria, and the ships of war cast anchor along the shore of the bay of Aboukir. The republican army marched on towards the Nile, and in proceeding along the banks of that river, they suffered much from the intense heat of the climate. They soon came to action with the Mamelukes, or military rulers of the country; but the small degree of skill possessed by these barbarians, was by no means a match for European tactics. Cairo surrendered on the 23d, and two days after, another battle was fought, in which the inhabitants were defeated. They made a last effort on the 26th, near the celebrated pyramids, when 2000 of them were killed, 400 camels with baggage were taken, and 50 pieces of cannon.

489 Tyranny and duplicity of Bonaparte.

Having proceeded thus far in his conquest of Egypt, Bonaparte framed for it a provisional government, and issued proclamations in the Arabian language, protesting that the French were friendly to the religion of Mahomet, owned the authority of the grand signior, and were only come to inflict punishment on the Mamelukes for doing so much injury to their trade with Egypt. Thus far the good fortune of Bonaparte seemed still to attend him; but on the 1st of August the fleet under Admiral Nelson appeared off the mouth of the Nile, who having discovered the position of the French fleet, prepared to attack it. In point of numbers the two fleets were upon a level, but as to weight of metal the French fleet was the stronger of the two. Admiral Nelson, by running some of his ships between the enemy and the land, surrounded one part of the fleet, while the rest were thus rendered entirely useless. The Culloden ran aground while this plan was carrying into effect; an advantage upon the whole, as it pointed out to the rest where the danger lay concealed. This memorable

France. 1798. morable action commenced with the setting of the sun, and continued, with occasional intervals, till the break of day. Nine sail of the line belonging to the French were taken; a ship of the line was burnt by her own commander, and the admiral's flag ship, L'Orient, was blown up during the action, few of her crew, consisting of 1000 men, having escaped destruction. Two ships of the line and two frigates were saved by flight, but afterwards captured.

490 Battle of the Nile.

If we confine ourselves to modern times, it will be difficult to point out any naval engagement productive of more interesting effects than this. The military exertions of France had by degrees destroyed the combination which the princes of Europe formed against her. The victories of Bonaparte had humbled the pride of Austria; the continent looked with dismay towards the new republic, and when the directory seized on Rome and Switzerland, no power ventured to interpose in their behalf. The aspect of affairs, however, had now undergone an almost total revolution. The once triumphant Bonaparte was shut up in a barbarous country, from which the fleets of Britain might prevent his return. Proposals were made by Great Britain to the northern powers, for the recommencement of hostilities against France, as it was not conceived possible that she could make such resistance as formerly. The states of Italy, too, determined to make a bold effort for the recovery of their independence. The court of Naples rejoiced at the destruction of the French fleet, and the king himself went to meet Admiral Nelson on his return from the Nile.

491 General Humbert invades Ireland.

It is well known that the French had long promised encouragement to the Irish rebels; but as their expectations were not gratified in time, they broke out into open rebellion without the promised assistance; and when the spirit of rebellion was almost wholly subdued, the directory attempted to land troops in small divisions, such as that under General Humbert on the 22d of August, consisting only of 1100 men, who landed at Killala. Yet this force, small as it was, would have proved formidable but a month before. They were joined by a party of the most desperate of the rebels in the vicinity, and defeated General Lake at the head of a superior force, taking from him six pieces of cannon. Their next step was to march in different directions to announce the arrival of the republicans, and maintained their ground for three weeks. This able general receiving no reinforcements from France, finding the rebellion in a great measure crushed, and being informed that General Cornwallis was about to surround him with 25,000 men, he laid down his arms to a British column, four days after he had dismissed his Irish associates, that they might provide for their own safety. Active measures were now taken by the directory to send troops to Ireland when too late, as the vigilance of British cruizers defeated all their endeavours. La Hoche, a ship of 84 guns, and four frigates, were captured by Sir John Borlase Warren on the 12th of October, in attempting to reach Ireland with 3000 men. On the 20th another frigate was taken, destined for the same country, which induced the directory to abandon the attempt as altogether desperate.

492 Imprudent conduct of the king of Naples.

The victory obtained by Admiral Nelson at the mouth of the Nile, made the king of Naples act the very imprudent part of preparing to commence hostilities against France. Without even waiting till the Austrians should commence the attack on the republican troops in the Roman territory, he procured General Mack to assume the command of his army. He began the war without any foreign aid, except the British fleet, and thus brought upon himself the vengeance of the French republic. The directory had no idea that he would adopt such conduct, and of consequence when General Mack appeared at the head of 45,000 men, the troops of France in that quarter were unable to contend with him. General Championet having justly complained of the attack made upon his posts, circumstanced as he was, he received for answer from the hostile commander, that his majesty had resolved to take possession of the Roman territory, and advised the French to retire quietly into the Cisalpine states, maintaining that their entrance into Tuscany would be considered as a declaration of war. Championet accordingly evacuated Rome, as he had no force against such a formidable army. He left a garrison in the castle of St Angelo, and concentrated what troops he could collect in the northern parts of the Roman state. General Mack entered the city of Rome without opposition in the end of November.

493 The French declare war against Naples and Sardinia.

These transactions having been known at Paris, war was immediately declared against their Neapolitan and Sardinian majesties, the latter of whom had committed no act of hostility against the French; but he was accused of disaffection to the republic, a charge which could scarcely fail to be true. He found himself placed in a very humiliating situation since the first entrance of Bonaparte into Italy, his strongest fortresses being in possession of the French, who levied on him what contributions they thought proper, and even placed a garrison in his metropolis. Being unable to go to war, he made a voluntary surrender of his continental dominions, and agreed to retire to the island of Sardinia.

A period was soon put to the dispute with Naples. As the French retreated, the country people gave them much trouble and uneasiness, and the Neapolitan troops scarcely observed the modern rules of war respecting such as they had taken prisoners. When General Bouchard, by orders from General Mack, commanded the castle of St Angelo to surrender, he maintained that he would view the prisoners in the light of hostages for the conduct of the garrison, and that a man should be put to death for every gun fired from the castle. It is scarcely to be imagined that the Neapolitan officers would have expressed themselves in such a shocking manner, if they had not calculated on the vigorous cooperation of the Austrian forces, in which, however, they were very much deceived. The consequence was, that the territory of Naples very soon fell into the hands of the French. Either the terror of the republican name was so great in Italy, or the cowardice of the Neapolitan troops, that they were defeated by one-fourth of their own numbers, at Terni, Porto Fermo, Civita Castellana, Otricoli, and Calvi. As the army of General Mack was gradually reduced to 12,000 men, in consequence of desertion and frequent defeats, he advised the king of Naples and his family to take refuge on board the British fleet, which was then lying at Leghorn. This advice was adopted, and they reached Palermo in Sicily on the 27th of December, in Admiral Nelson's ship. General Mack having requested an armistice,

mistice, it was refused by the French commander. Being driven from Capua, the only remaining post of any consequence in the territory of Naples, and being in the greatest danger from the disaffection of his troops, he surrendered himself and the officers of his staff to the republican general. The governor of Naples offered a contribution of money if the French troops would not enter that city, which was agreed to, and they remained at Capua. General Serrurier, at the head of a French column, drove the Neapolitans out of Leghorn, and took possession of that place.

494 Desperate conduct of the Lazzaroni.

Such is the mildness of the climate in the southern parts of Italy, that the people can subsist with fewer efforts of industry than in almost any other country of Europe. This naturally begets an indolent disposition, which is cherished by a number of charitable institutions originating from the Catholic religion. In Naples there had long been a body of men called Lazzaroni, or beggars, amounting to the astonishing sum total of near 40,000, who entirely subsisted on charity. They frequently threatened the state if they did not receive an immediate supply of their wants, which procured them very liberal contributions. Having been informed that the French, wherever they came, destroyed all monasteries and other sources of charity, they determined to oppose them to the utmost of their power, and appear the advocates for royal government. In the beginning of January 1799, they exhibited marks of discontent, and at last broke out into an open insurrection. They appointed Prince Militorni their commander in chief, who made many fruitless efforts to restrain their violence and love of plunder. They declared war against the French, forced the prisons open, and murdered all who had been incarcerated for disaffection to the kingly government. Their ravages now became so dreadful and boundless, that Prince Militorni abandoned them, set out to Capua, and requested Championet to take possession of the city, in order to rescue it from utter destruction. It was agreed that a column of French troops should take a circuitous route, and enter the city from the opposite quarter. Before this plan could be carried into execution, two thirds of the Lazzaroni marched out on the 19th and 20th of January, with the daring resolution to attack the French in the fortifications of Capua. Multitudes of them perished by the French artillery; and in order to favour the capture of Naples by the party sent on that expedition, Championet made no sally out upon them, but continued on the defensive. The Lazzaroni being informed on the 21st that a French column had marched for Naples, returned to the city; and although Championet closely pursued them, they arrived in time to barricade the streets, and prepare for the defence of different quarters. A terrible conflict now commenced, which lasted from the morning of the 22d to the evening of the 23d of January. Having been driven from street to street, they finally rallied at one of the gates of the city, where they were almost totally cut off. It is certainly a reproach to the Neapolitan government, not to have been able to give a better direction to the undaunted courage of such men.

495 The directory becomes unpopular.

We may view this triumph as the last which the directory enjoyed, for the consequences of their past conduct were now rapidly gathering around them. They were with the greatest justice unpopular at home, both from their mode of conducting public affairs, and their repeated violations of the constitution of their country. Their profusion was unlimited, as well as the exorbitant demands which they made upon conquered countries. Championet was so ashamed of them, that in Italy he endeavoured to restrain them, in consequence of which he was deprived of his command, and thrown into prison; Scherer, the war minister, being appointed his successor. Under him the rapacity of the government agents, and the embezzlement of the public stores, were carried as high as possible. Yet France still continued to be dreaded by foreign nations, to whom the true state of internal affairs was but obscurely known. An army of 45,000 Russians had arrived to the assistance of Austria, yet that cabinet was at a loss whether to declare war or not. Britain solicited the aid of Prussia, with an offer of large subsidies; but Sieyes, the plenipotentiary at Berlin, artfully contrived to defeat the negotiation, and counteract the unpopularity of his country in Germany, by giving to the world the secret convention of Campo Formio. This determined the greater number of the German princes to maintain their neutrality under the guardianship of Prussia.

A note was presented to the congress at Rastadt on the 2d of January by the French plenipotentiaries resident there, intimating, that if the entrance of Russian troops into Germany was not prevented, it would be considered as tantamount to a declaration of war. To this no satisfactory answer was returned. The strong fortress of Ehrenbreitstein surrendered on the 26th of that month, after being blockaded since the treaty of Campo Formio. This possession, together with Mentz and Dusseldorf, made the French a very powerful enemy on the Rhine. Switzerland also belonged to them, and all the fortified places of Italy, on which account they were qualified to commence active operations. At this period Jourdan commanded on the Upper Rhine from Mentz to Huningen; the eastern frontier of Switzerland was occupied by General Massena; Scherer had the chief command in Italy; Moreau acted under him, and Macdonald commanded the troops in the territory of Rome and Naples. Yet all these armies so scattered, did not exceed 170,000 men, a force greatly inferior to that of Austria, altogether independent of the Russian army. The directory, however, trusting to the unity of its own plans, the wavering politics of the court of Vienna, and the slow movements of the imperial armies, was anxious to renew the war, a declaration of which against the emperor of Germany and the grand duke of Tuscany, was made on the 13th of March.

496 War declared against the emperor and grand duke of Tuscany.

Jourdan had actually crossed the Rhine at Strasburg on the 1st of that month, and occupied many strong positions in Swabia. Manheim was taken, and General Bernadotte summoned Philipsburg to surrender, while General St Cyr entered Stutgard. In order to oppose the march of this army, the archduke Charles crossed the Lech on the 4th of March; Massena marched into the territory of the Grisons, and surprising a strong body of Austrians, made the whole of them prisoners, together with their general, and the whole of his staff, in consequence of which the country of the Grisons was reduced.

The republican plan of procedure was not completed without the junction of Massena's and Jourdan's armies, to accomplish which it was necessary to carry the important

portant post of Feldkirch, which was held by General Hotze. Defeated in his first attempt, Massena renewed the attack five times with fresh forces, but the determined bravery of the Austrians rendered them ineffectual. But as the French were in possession of the Grisons, the invasion of the Engadine was facilitated, where the Austrians being too weak to resist, retreated into the Tyrol, and were pursued by the republicans, who forced some of the defiles, and extended their inroads as far as Glurentz and Nauders.

The vanguard of the principal Austrian army pushed on to meet the French. It was attacked by Jourdan on the 20th of March, by whom the outposts were driven in; but the centre of his army was attacked on the following day, and forced to retire to Stockach during the night. The archduke encamped before Stockach on the 24th, and the republicans attacked him on the following day. His right wing under General Meerfeldt was their main object, which they succeeded in driving into a wood between Liptingen and Stockach. Meerfeldt renewed the conflict without success. The left wing having maintained its ground, sent reinforcements to General Meerfeldt, who in his turn obliged the French to retire. The French, however, made 4000 prisoners during the various movements of the day. Yet their loss was so great, and the Austrian force so vastly superior to their own, that General Jourdan durst not hazard another engagement. He retreated on the following day, and feeling that he was not a match for the enemy, he sent a part of his army to recover Kehl and Strasburg. and marched with the remainder towards Switzerland. By this event General Massena, who was forcing his way to the Tyrol and Engadine, was obliged to return to the protection of Switzerland. He was appointed to the chief command in this quarter, and Jourdan was removed.

497 Success of the Austrians in Italy.

The Austrians were no less successful in Italy, notwithstanding they were attacked by the French before the termination of the armistice. General Kray obtained a complete victory over them at Legnago, and forced them to flee for protection under the walls of Mantua. On the 15th of April they were again attacked by the Austrians at Memiruolo, and again forced to retreat after an obstinate resistance. The loss sustained by the French in these different engagements was unquestionably great, but we should apprehend that the account which states it at 30,000 men in killed, wounded, and prisoners, must surely be exaggerated, But the Austrians may be said to have purchased these victories at a dear rate. Scherer at first gained some advantages over them, but he had not skill to improve them, else they would have unquestionably given a new turn to the aspect of affairs. The Austrian posts were forced by a division of his army on the 26th of March, and 4000 prisoners taken; but on the other division being repulsed, he withdrew his troops, and thus relinquished the advantages he had obtained. On the 5th of April the division under Moreau performed wonders, and took 3000 prisoners; but by the unskilful measures of Scherer he was not supported, and the triumph of the Austrians was of course complete.

498 The Russians and imperialists united under Suwarrow.

Prior to this period, a body of Russians joined the imperialists, and the command of this combined army was given to Field-marshal Suwarrow Rimniski, who advanced towards the Adda on the 24th of April; and after carrying the outposts of General Moreau, Suwarrow determined to attack him in his entrenchments. He maintained the appearance of attack along the whole line of Moreau, while he secretly threw a bridge over among the rocks at the upper part of the river, where such a thing had been considered as impossible. By means of this bridge a part of the combined army next morning turned the republican fortifications, and attacked their flank and rear, while the rest of the army forced the passage of the river at different points. The French fought with their usual intrepidity, but were soon driven from all their positions, and forced to retreat to Pavia, with the loss of 6000 men killed, 5000 made prisoners, including four generals, and 80 pieces of cannon.

General Moreau now established the poor remains of his army, amounting to 12,000 man, upon the Po, between Alessandria and Valentia. He forced, on the 11th of May, a body of Austrians, to retreat, and took a number of them prisoners. On the 12th, about 7000 Russians crossed the Po at Basignano, and marched on towards Pecetto, when Moreau fell upon them with fury; and they refusing to lay down their arms, about 2000 of them were drowned in repassing the river, and a few were taken prisoners. On the advance of Suwarrow, General Moreau was under the necessity of retiring to occupy the Bochetta, as well as other passes which lead to the territory of Genoa, when the combined army began the sieges of the fortified places in Italy then occupied by the French. Bellegarde drove the French from the Engadine; Massena was obliged to retire to the vicinity of Zurich, he was so pressed by the archduke; and nearly the whole of Piedmont had risen against the republicans. They received no reinforcements from the interior of France, and their officers were obliged to act on the defensive, to defend the frontiers as long as possible. In one instance only they had the power of making offensive war, and it was certainly done with great vigour. General Macdonald had still a considerable army in the southern parts of Italy, in the territories of Naples and Rome. The combined powers had made no effort to cut off his retreat, convinced, perhaps, that this could scarcely be accomplished in the mountainous countries of Tuscany and Genoa. Knowing his situation to be secure, he was in no hurry to remove, although nearly the whole country between him and France was occupied by the combined army. His army amounted to about 30,000 men, and he received orders from the directory to leave the territories of Rome and Naples, and unite, if possible, with the army of Moreau. From the situation of the allies, however, he resolved to hazard an action by himself. With Moreau he had concerted a plan for dividing their enemies, and vanquishing them in detail, as Bonaparte had so often done in Italy before. Macdonald alone was in a situation for striking an important blow, yet it was necessary for Moreau to draw upon himself as many of the Austro-Russian forces as possible, that the remainder might be more completely exposed to the attack of Macdonald.

499 Artful stratagem of Moreau.

Moreau availed himself of the circumstance of the French and Spanish fleets being in the vicinity of Genoa, to spread a report that they had brought him a very powerful reinforcement, intending thereby to withdraw the attention of Suwarrow from Macdonald. The

Russian

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Russian general was at Turin, his advanced posts at Susa, Pignerol, and the Col d'Assiette, while General Hohenzollern was stationed at Modena with a considerable force, and General Ott at Reggio with 10,000 men. General Macdonald began his operations on the 12th of June, when his advanced divisions attacked and defeated Hohenzollern, taking 2000 of his men prisoners. General Ott was attacked at the same time, and being compelled to retreat, the French made their entry into Parma on the 14th. He was again attacked on the 17th, and forced to retire towards Giovanni, where the progress of General Macdonald was arrested.

498 The French defeated by Suwarrow.

Suwarrow having received information of his approach, and of his successes, left Turin on the 15th of June, at the head of 20,000 men, and came up with Macdonald on the banks of the Tidone. The centre and right wing of Suwarrow's army were commanded by Rosenberg and Foerster, the Austrian general Melas commanded the left wing; Prince Procration was at the head of the advanced guard, and Prince Lichtenstein of the reserve. An action immediately commenced, which was fought with desperate fury on both sides for three successive days, when victory declared in favour of Suwarrow. Driven from Tidone to the Trebbia, the French were finally vanquished on the 19th, after a greater slaughter on both sides than the oldest officer present recollected to have witnessed. Victory remained doubtful, till General Kray arrived with large reinforcements from the army besieging Mantua, and, in direct contempt of his orders, decided the fate of the day.

The republicans retreated during the night, and the next day they were pursued by the army of Suwarrow in two columns. Seldom could the French be overtaken in a march, but the army of Suwarrow accomplished this, when he surrounded the rear-guard of the fugitives, and obliged them to lay down their arms. The rest of the army defended themselves in the passes of the Appenines and territory of Genoa, after losing, it is said, no fewer than 17,000 in killed, wounded, and prisoners. Moreau, in the mean time, gave battle to the Austrians under Bellegarde, and though far superior to him in numbers, they were totally defeated. This temporary advantage, however, availed little, in consequence of the rapid return of Suwarrow from the pursuit of Macdonald. The fortresses in Italy surrendered in close succession, and it appeared as if the combined powers would soon be able to enter the territory of France.

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The affairs of the republic became equally critical in Palestine. After having defeated the Mamelukes, made himself master of Alexandria and Cairo, and avowed himself a Mahometan in Egypt, Bonaparte led an army into Palestine, to take possession of Jerusalem, and by rebuilding the temple, and restoring the Jews, to give the lie to the prophecies of the Christian religion. At the head of 10,000 men, with officers eminently skilled in the art of war, he reached the town of Acre on the sea-coast, 28 miles south of Tyre, and 37 north of Jerusalem. He laid siege to this town in due form, which was but indifferently fortified, and defended by a small garrison of Mussulmans, which the governor would have unconditionally surrendered, had he not been advised to make a vigorous resistance by an English naval officer. Sir Sidney Smith having received the command of the garrison, detained Bonaparte before Acre 69 days, although the number of the allies by whom it was defended did not exceed 2000 men. The French commander made eleven attempts to carry it by assault, all of which proved unsuccessful. He was at last obliged to raise the siege, after he had lost eight of his generals, 85 inferior officers, and almost one half of his army. His unsuccessful attempt upon Acre must indeed appear important, especially to Britain, if it be true that the Druses, to the number of 60,000 men, had promised to join him on the reduction of that town. Had this junction been effected, it is believed that Constantinople would have become their prey, which was first to have been plundered, and then reduced to ashes.

500 The directory sinks into contempt.

While France experienced such reverses abroad, she was much disturbed also by internal commotions, and the directory found itself in a very critical situation. New elections were still unfriendly to their interest; and they could no longer secure a majority in the councils, they were sunk into such contempt. When they sought money, they obtained reproaches on account of their own profusion, and the agents they employed. Insurrections in the west and south were formed by the friends of royalty, and these were with difficulty subdued, on account of the absence of the military. In the midst of all these difficulties, the occurrence of one event seemed to promise the directory the return of their former influence. On the 28th of April, the French plenipotentiaries received orders to quit Rastadt in 24 hours. Having demanded a passport from Colonel Barbasey, they received for answer that none could grant it but the commander in chief. They at last began their journey, the three ministers, Bonnier, Roberjot, and Jean Debry, were in separate carriages, Roberjot having his wife, and Jean Debry his wife and daughters along with him, attended by the ministers of the Cisalpine republic. At a short distance from Rastadt they were met by 50 Austrian hussars, who stopped the carriage of Jean Debry, and demanded his name. Of this he informed them, adding that he was a French minister returning to France. He was immediately torn from his carriage, desperately wounded with sabres, and thrown into a ditch for dead. Bonnier and Roberjot were murdered on the spot. When the ruffians departed, and the carriages returned to Rastadt, Jean Debry wandered all night in the woods, and next day returned to Rastadt. He demanded the restitution of the papers which the *hired* assassins had carried off when they plundered the carriages, but they were refused. Rastadt and its vicinity was occupied by French troops during the long sitting of congress, of which the Austrians had obtained possession but a few days before. The discipline, therefore, of the Austrian army was severely reproached by this event; but it is probable that more than the want of subordination was at the bottom of a crime so atrocious, unprecedented, and totally repugnant to the laws of nations. It is true, the archduke lost no time to declare his utter ignorance of the matter in a letter to Massena; but this was far from giving satisfaction to the French directory. In a message to the councils on the

501 Murder of the French ambassadors at Rastadt.

the 5th of May, they made it the premeditated act of the Austrian government, to insult France by the murder of her ambassadors.

502 Sieyes chosen a member of the directory.

A violent opposition to the directory commenced by the introduction of the new third of this year. Sieyes, who was ambassador at Berlin, and had possessed considerable influence over all parties, was elected a member of the directory. This station, we have already seen, he refused to occupy at the first establishment of the constitution, and therefore his acceptance of it at such a critical juncture, excited great surprise. Treilhard was removed from the directory, as it was said that he had held an office in the state within less than a year previous to his election. Merlin and Reveillere were under the necessity of resigning, to avoid an impeachment which was threatened to be brought against them; but Barras still retained his station. Moulins, Gohier, and Ducos, men who were but very little known, and far from being leaders of the contending parties, were chosen members of the directory. The public spirit was attempted to be revived by the establishment of clubs, a liberty of which the restless Jacobins first took advantage. They soon proposed violent measures, and began to denounce the members and the conduct of government. But their intemperance having justly alarmed the directory, they obtained permission from the councils to suppress their meetings, before they had time to corrupt the public mind.

503 General Joubert is killed, and the French retreat under Moreau.

The directory now employed every effort to augment the armies which had lately suffered such dreadful diminutions. In the beginning of August their army in Italy amounted to 45,000 men, of which General Joubert had the chief command. Turin, Alessandria, Milan, Peschiera, and Ferrara, were captured by the allies with astonishing rapidity. Turin sustained a bombardment of only three days, Alessandria held out seven, and Mantua only fourteen, in which last place there were 13,000, who were dismissed on their parole. The combined powers next laid siege to Tortona, and General Joubert resolved on its relief, which object he expected to accomplish before the arrival of Kray with assistance to Suwarrow. The whole of the Austrian posts were driven in by the republicans on the 13th of August, who took possession of Novi. On the 15th they were attacked by Suwarrow, who by this time had received troops from Mantua under General Kray. The right wing was commanded by this officer, its left by Melas, and its centre by Prince Procration and Suwarrow in person. The engagement commenced about five o'clock in the morning, soon after which, while General Joubert was urging his troops forward to charge with the bayonet, he received a musket shot in his body, and falling from his horse, he immediately expired. Moreau assumed the command, and after a bloody conflict, the allied army gave way in all directions. The Russians in particular suffered severely, from the obstinate manner in which they fought. The French line was attacked at three in the afternoon, but remained unbroken; and the whole would have terminated in the defeat of the allies, if General Melas had not turned the right flank of the republican line; and following up his advantages, he got possession of Novi, when the French army began to retreat under the command of General Moreau.

The Austrians say that the French upon this occasion lost 4000 men killed, and the same number taken prisoners, confessing that their own loss was equal to this; but the loss of the Russians was never published. We have reason to believe that it was the greatest of the whole, since they will rather stand and be cut to pieces than think of retreating. The French lost all hope of being able to defend Genoa, and therefore prepared to evacuate that city and territory. It was now the apprehension of the directory that the south of France would immediately be invaded, but in this they were happily deceived. The conquered army was astonished to find itself unmolested after so signal a defeat, and in a few days ventured to send back parties to reconnoitre the movements of the allies. Championet, the successor of Joubert, was amazed to find that they had rather retreated than advanced, on which account he resumed the positions held by his army before the battle of Novi.

504 Suwarrow marches to the relief of Switzerland.

So far from prosecuting the advantages they had obtained in Italy, Suwarrow was persuaded to abandon that country with his Russian troops, and march to the deliverance of Switzerland from the yoke of France. The army of Massena in this quarter amounted to 70,000 men in the month of August, which not only prevented the archduke from pursuing his advantages, but the French even threatened to endanger his position. Massena's right wing under General Lecourbe had carried Mount St Gothard, the great pass leading from the eastern parts of Switzerland into Italy. Suwarrow's expectations were no doubt high, having never yet been vanquished, and being called upon to undertake an enterprise in which the Austrians had hitherto failed, even under their most fortunate general. When he was ready to march, the Austrian commander in Italy refused to give him mules for transporting his baggage. This officer had recourse to a most pitiful falsehood, when he asserted that he would be furnished with a competent number at Bellinzone, where Suwarrow could find none. Having no other alternative, he dismounted the cavalry, and made use of their horses to drag along the baggage. In spite of these obstacles, however, he arrived, by forced marches, on the frontiers of Switzerland on the day which he and the archduke had fixed upon.

Either supposing that it would demean a prince of the house of Austria to serve under a Russian general, or not being daring enough to require the most experienced general in Europe to receive orders from so young a man as the archduke, that prince was sent into Swabia to attack a small body of republicans. He took with him 48,000, some say 60,000 men, although 20,000 would have been more than sufficient for the accomplishment of such an undertaking. It is not an easy matter to conceive upon what principle the council of war at Vienna could imagine, that such an able officer as Massena would continue inactive at the head of an army almost the double of that which was sent to oppose him. The archduke marched against the French in Swabia, who resisted him as much as the small number of their troops would permit; but they were gradually driven towards the Rhine. To carry on the deception, they made a serious stand in the vicinity of Manheim, where they lost 1800 men, and which the Austrians entered, seemingly determined to cross the Rhine.

Switzerland in the mean time was completely exposed

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posed to the army of Massena. The right wing of the combined army in this country was commanded by General Hotze; the centre, composed of the newly arrived Russians, was headed by Korsakof; and the left wing by General Nauendorf. As soon as Massena understood that the archduke had entered Manheim, and that Suwarrow was approaching to Switzerland by the way of St Gothard, he began his movements. St Gothard was defended by Lecourbe, and in the mean time Massena determined to anticipate the arrival of Suwarrow. Having drawn the attention of the Russians to another quarter on the 24th of September, by a false attack, he suddenly crossed the Limmat, three leagues from Zurich. Some of the French troops engaged the Austrians, but the principal part of the army marched against the Russians. General Hotze fell in the beginning of the action, and Petrasch who succeeded him shunned a total defeat, by retiring in the night with the loss of 4000 men. The Russians fought with very singular obstinacy, being in a mountainous country to which they were strangers, and fighting against the most able commanders in Europe. It was in vain, however, to attempt putting them to flight, for even when surrounded they would not lay down their arms, but stood to be slaughtered on the spot. The Austrians having retreated on the 25th, the Russians on the 28th followed their example, retreating under General Korsakof in good order, and with the loss of 3000 men, which was not very great, considering his perilous situation.

505 Suwarrow disgusted with the conduct of Austria.

During these transactions, General Suwarrow was proceeding by the way of Italy with an army of 18,000, but others say no more than 15,000 men. He carried the pass of St Gothard, and descended into the valley of Urseren, driving Lecourbe before him with great slaughter, and advanced as far as Altorf. He next day reached the canton of Glaris, and made 1000 of the French prisoners, and General Linken defeated another corps of 1300 men. Massena now turned upon Suwarrow, and by surrounding him on all sides, expected to take him and the grand duke Constantine prisoners. Suwarrow defended himself in a very masterly manner, and there being only one pass in the mountains unoccupied by the republicans, the aged hero discovered it, and by this he effected his escape, but lost his cannon and baggage among the dreadful precipices with which that country abounds. He made his way through the Grison country, and arrived at Coire with about 6000 men. Suwarrow felt truly indignant when he found in what manner affairs had been conducted, the perilous situation in which the Russians had been left by the archduke, and the destruction which of consequence they had met with. He considered himself and his men as treacherously betrayed, complained bitterly of the commander of the allies in Switzerland, and publicly charging the council of Vienna with selfishness and injustice, refused to co-operate farther with the Austrian army. He transmitted an account of the whole in a letter to Petersburgh, and withdrew his forces to the vicinity of Augsburg to wait for further orders from his court.

506 Britain prepares to invade Holland.

Great Britain in the mean time made active preparations to invade Holland, with an army of 40,000 men, composed of British troops and auxiliaries from Russia. The first division under General Sir Ralph Abercromby sailed in the month of August, protected by a fleet under Admiral Duncan. Bad weather prevented any attempt to land the troops till the 27th, on the morning of which day the debarkation was effected on the shore of Helder Point without oppostion. They were not expected to land in North Holland, on which account the troops in that neighbourhood were few. But before the British troops had proceeded far on their march, they had to contend with a considerable body of infantry, cavalry, and artillery, hastily collected from the adjacent towns. The Dutch fought with great obstinacy, but became fatigued by the steady opposition of their antagonists, and fell back about two leagues. They evacuated the fort of Helder in the night, and it was taken possession of by the British on the morning of the 28th. Admiral Mitchell now enterεd the Zuyder sea with a detachment of the British fleet, in order to give battle to the Dutch under Admiral Story. Instead of retiring to the shallow water with which that sea abounds, he unaccountably surrendered his whole fleet on the 30th of August without firing a gun, pretending that from the mutinous disposition of his seamen, he could not prevail upon them to fight.

507 Which is ill conducted.

If this had terminated the expedition, it would have been extremely fortunate, as establishing the power of the British fleet without a rival. But this victory, if it can be so called, was followed up by an endeavour to restore the authority of the stadtholder, and the ancient government of the United Provinces. As no more than the first division had arrived, the terror of an invading foe began to be dissipated, the enemies of the new government were disheartened, and time was allowed to prepare for defence. But these were not the only errors chargeable on the expedition. The British troops landed in the very worst place they could possibly have chosen, not only as it is everywhere intersected by ditches and canals, but it abounded more than any other part of Holland, with persons disaffected to the person and government of the stadtholder. In a word, this unfortunate expedition was undertaken towards the approach of the rainy season, when a campaign in Holland is next to impossible. When it was first spoken of, even the French directory hesitated to undertake the defence of that country; but when the time and place of landing came to be known, they were soon determined, being almost certain of success. General Brune was accordingly sent with what troops could be speedily collected, in order to co-operate with General Daendals.

General Abercromby in the mean time could only act on the defensive, as no reinforcement had arrived. The enemy was encouraged by his want of activity, and ventured to attack him on the 10th of September. Two Dutch columns, and one of republicans, advanced upon him, but were repulsed in every direction, and forced to retreat to Alkmaer. Additional troops arrived on the 13th, under his royal highness the duke of York, who assumed the chief command. On the arrival of the Russians, offensive operations were immediately resolved on, and the army advanced on the 19th. The left wing under General Abercromby marched along the shore of the Zuyder sea to attack Hoorne; Generals Dundas and Pultney commanded the centre columns, and the Russians were led on by their own general D'Herman. Owing to some misunderstanding, the Russians advanced to attack the enemy

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about three o'clock in the morning, which was some hours before the rest of the army began its march. Their first efforts were crowned with success, and they made themselves masters of the village of Bergen; but as they pressed too eagerly forward without the co-operation of the other columns, the enemy nearly surrounded them. Their general was made prisoner; and notwithstanding the British troops came up in time to secure their retreat, they lost upwards of 3000 men. This defeat of the right wing made the commander in chief recal his troops from their advanced positions, notwithstanding General Abercromby was master of Hoorne and its garrison, and General Pultney had carried by assault the chief position of the Dutch army.

Such was the severity of the weather, that no fresh attack was made till the 2d of October, on which day a desperate action commenced between the British, and the united Dutch and French troops, at 6 o'clock in the morning, which did not terminate till the same hour at night when the British gained possession of Alkmaer and the neighbouring villages. This engagement having been chiefly carried on among the sand hills near the ocean, the fatigue which the troops endured, prevented them from gaining any great advantage over the fugitives, who took a position between Baverwycke and Wyck-op-zee, where the duke of York again attacked them on the 6th, and kept possession of the field after a very sanguinary contest. This, however, was the last success gained by the invading army. The duke of York finding that he could make no farther progress, the enemy having been so rapidly reinforced, the difficulties presented by the face of the country and the badness of the weather also conspiring against him, retired to Schager Brug, where he waited for orders from England relative to his return home. Being in the mean time closely pressed by the enemy, his embarkation must have been accomplished with great danger, had he not entered into a convention with the Dutch and French, that his retreat should not be molested farther, in return for which he promised not to injure the country by demolishing any of the dykes which defended it from the sea, and that Great Britain would restore to France and Holland 8000 prisoners taken before the present campaign.

The affairs of the French republic now began, in consequence of these events, to wear a more favourable aspect. It is true, Championet was defeated in Italy in all his efforts against the Austrians, and Ancona surrendered on the 13th November to General Frolich; but the French were still masters of the Genoese territory, Switzerland and Holland, and the new combination formed against them seemed about to be dissolved. Prussia withdrew at an early period, and still preserved a neutrality; and from existing circumstances it was natural to conclude, that the emperor of Russia would also desert the cause of the allies.

508 The Turks defeated by Bonaparte near the Pyramids.

An event took place about this time which presented the revolution of France in a light never before seen. Our readers will recollect that General Bonaparte was obliged to retreat from Acre with great loss, after a siege of 69 days. At this time he received information that a Turkish army was about to invade Egypt by sea, and therefore he returned across the desert of Arabia by the way of Suez, and arrived in the vicinity of the Pyramids on the 11th of July, when an army of 18,000 Turks landed at Aboukir, which they carried by assault, and put the garrison to death, consisting of 500 men. Bonaparte marched down the country against them on the 15th, and ten days after came in sight of them at six o'clock in the morning. Their troops were divided into two parts, encamped on the opposite sides of a delightful plain. The cavalry of Bonaparte advanced with rapidity into the centre of the Turkish army, cutting off the communication between its different parts. Struck with terror, the Turks endeavoured to gain their ships, when the whole of them perished in the sea. The left division made a more obstinate resistance, but it was at length defeated. About the end of September the news of this victory reached France, which recalled the memory of Bonaparte's conquests, as forming a striking contrast to the reverses experienced by the republic after that period. The directory received a dispatch from him on the 10th of October, which was read to the councils; and on the 14th a message announced the arrival of Bonaparte in France, together with his principal officers. He was received at Paris with marks of distinction, although none could tell why he had left his army and returned home. At this time the parties in the government were equally balanced; and the assistance of Bonaparte was requested by both. The Jacobins were superior in the council of five hundred, and the Moderates in that of the Ancients. It was understood that Sieyes was attached to the latter party, on which account the Jacobins had made many unsuccessful efforts to dismiss him from his office. Intriguing as the Jacobins were, they were fairly outwitted by Sieyes, who had a plot ripe for execution, to overwhelm them in a moment. On the morning of the 9th of November, one of the committees of the council of Ancients gave in a report, that the country was in danger, proposing the sitting of the legislature to be adjourned to St Cloud, about six miles from Paris. The council of five hundred having no legal right to question the authority of this decree, and as the ruling party was clearly taken unawares, the members gave their silent consent, and both councils met at the place appointed on the 10th of November.

509 Who returns to France—subverts the directorial government.

The council of five hundred received a letter from Lagarde, secretary to the directory, informing them that four of its members had resigned their offices, and that Barras was a prisoner by order of Bonaparte, whom the council of Ancients had appointed commander of their guard. In the midst of their deliberations, General Bonaparte entered the hall, accompanied by about 20 officers and grenadiers. He proceeded towards the chair where his brother Lucien sat as president, when great tumult ensued, and the epithets of a Cromwell, a Cæsar, and a usurper, were conferred upon him. The members pressed forward upon him, and Arena a Corsican endeavoured to dispatch him with a dagger; but he was rescued by his military attendants. A party of armed men entered the hall, and carried off the president, when in a violent debate which ensued, it was proposed that Bonaparte should be declared an outlaw. Military music was soon heard approaching; a body of armed troops entered the hall, and the members were obliged to disperse. The council of Ancients set aside the constitution, and passed a number of decrees. The directory was abolished, and an executive commission substituted in its place, consisting of Bonaparte, Sieyes, and

and Roger Ducos, under the denomination of consuls. The sittings were adjourned till the 20th of February 1800, and two committees, consisting of 21 members, chosen from both councils, to act as interim legislators. The greater part of the members composing the council of five hundred returned to Paris, having been expelled from the hall by the military, while part of them continued, and sanctioned all the decrees of the council of ancients. On the 17th of November the consuls decreed the transportation of a great number of Jacobins to Guiana, and cast a number of them into prison; but these decrees were soon after reversed, and every thing assumed an air of tranquillity.

The expedition to Egypt was in the mean time unsuccessful in every one of its objects. Tippoo Sultan, son and successor to the celebrated Hyder Ally, sovereign of the Mysore country, had, in the year 1792, been under the necessity of concluding a treaty of peace with Lord Cornwallis under the walls of Seringapatam, in which he resigned a portion of his territory to the invaders, and agreed to pay a very considerable sum of money. He was likewise obliged to deliver up two of his sons as hostages for the punctual performance of every thing stipulated. A war which terminated in this manner could not reasonably be expected to become the basis of much cordiality. He was indeed obliged to submit, but he only waited for a favourable opportunity to recover what he had lost, and to accomplish, if possible, the total expulsion of the British from India, which with him was a favourite object, as it had always been with his father. The ascendancy of Britain, however, was now so great, chiefly owing to the exertions of Warren Hastings, Esq. that Tippoo clearly perceived the impossibility of shaking it, without the assistance of an army from Europe. To no country but France could he look for an adequate force; but the foreign and domestic wars arising from the revolution, had prevented the rulers of that nation from attending to the interests of distant regions. In 1797, Tippoo determined to renew his intercourse with France by means of the islands of the Mauritius and Bourbon. One Ripaud, formerly a lieutenant in the French navy, who had resided for some time at Seringapatam, persuaded Tippoo that the French had a considerable force at the Mauritius, which with little difficulty might be sent to his assistance. Ripaud being sent to confer with the French upon the subject, he and two ministers from Tippoo were joyfully received by Malartic the governor, and vessels were sent to France to acquaint the directory with their proposals.

Ta[...]o-tion of Tippoo Saib watched by Brit[...].

The governor Malartic in the mean time, either from gross ignorance, from treachery, or a wish to involve Tippoo Sultan in a quarrel with Britain, adopted a measure which ultimately defeated the plans, and brought about the ruin of that prince. On the 30th of January 1798, he published a proclamation, containing the whole of Tippoo's confidential proposals, inviting all citizens of France to espouse his cause. Copies of this proclamation soon found their way into most quarters of the world. Accordingly the governor-general of India, received orders to watch the motions of Tippoo, and even hostilely attack him if it could not be prudently avoided. The Indian government, however, had, before this, been apprised of the impending danger, and had made preparations for war without loss of time.

But Tippoo did not place his sole dependence on assistance from France. He invited one Zemaun Shah from the north-west, whose kingdom was composed of provinces taken from Persia and India, to make an attack upon the British and their allies. In hopes of direct aid from France, which Tippoo expected in consequence of Bonaparte's invasion of Egypt, and the important service which he looked for from the exertions of Zemaun Shah, he remained quiet, and endeavoured to temporise with the British. Military preparations on the part of the British being in a considerable degree of forwardness, Lord Mornington, the governor-general, informed Tippoo that he was not ignorant of his hostile designs, and of his connection with France, proposing, however, to send an ambassador for the purpose of bringing about a reconciliation. This was not answered till the 18th of December, although written by his lordship on the 8th of the preceding month. Tippoo simply denied the charge, and refused to admit the ambassador. Unwilling to sport with human blood, his lordship on the 9th of January 1799, again intreated Tippoo to receive the ambassador, to which no answer was returned during a whole month, during which interval 5000 men arrived from England, and General Harris received orders to advance at the head of the Madras army against the kingdom of Mysore. This seemed to bring Tippoo a little more to reason, who now offered to receive the ambassador, on condition he should come without any attendance; but as this was not deemed a satisfactory concession, the army continued to advance. An army from Bombay was also approaching on the opposite side of his dominions, which encountered part of Tippoo's forces, and defeated them; General Harris defeating the remainder of them on the 27th of March, who on the 7th of April sat down before Seringapatam. This officer received a letter from Tippoo on the 9th, in which he mentioned his adherence to treaties, and wished to be informed as to the cause of the war. The only answer he received was a reference to Lord Mornington's letters. He made another attempt on the 20th, and General Harris informed him that he had already been made acquainted with the only conditions which could or would be granted. The half of his dominions was to be surrendered, large sums of money were expected from him; he was to admit an ambassador to his court, to disclaim all connection with the French, and grant hostages for the faithful observance of every stipulation.

511
Proposals of Tippoo rejected.

Tippoo wrote a letter to General Harris on the 28th, desiring leave to treat by ambassadors, which was refused him, as he was in possession of the *sine qua non* of the British government. It was believed that the besieging army would have been obliged to retreat, had it been possible for Seringapatam to hold out only a fortnight longer. On the last day of April the besiegers began to batter the walls of the city, and they got possession of it on the 4th of May. Tippoo hastened from his palace to the attack, when given to understand that a breach was made in the walls, where he fell undistinguished in the general conflict. His treasures and the plunder of the city were immense, with which the besieging army was enriched, after deducting a certain proportion for the British government and the East India Company. His subjects immediately surrendered, and

France, 1799.

and that part of the country which formed the ancient kingdom of Mysore, was conferred on a descendant of the former race of its kings, and the remaining territories were divided among the British and their allies. The family of Tippoo were either taken or made a voluntary surrender, being removed from that part of the country, and allowed a decent annuity.

Zemaun Shah in the mean time invaded the country from the north-west, advancing to the vicinity of Delhi, and spreading terror and desolation wherever he came. Satisfied with plunder, however, he soon withdrew his forces; and the French army being detained in Egypt by a war with the Turks, as well as the want of shipping at Suez, Tippoo had to contend singly against the united forces of Britain and her allies in those eastern regions.

512 A consular government established in France.

The plan of a new constitntion was presented to the public by the consuls in the month of December 1799. According to this plan, 80 men, who had the power of nominating their own successors, and were called the conservative senate, had likewise authority to elect the whole of the legislators and executive rulers of the state, while none of these offices could be held by themselves. One man, called the *chief consul*, possessed the sovereign authority, held his power for ten years, and was competent to be re-elected. Other two consuls were to assist in his deliberations, but had no power to controul his will. The legislative power was divided into two assemblies; the tribunate, composed of 100 members, and the conservative senate of 300. When the chief consul thought proper to propose a law, the tribunate might debate upon it, without having authority to vote either for or against it, while the members of the senate might vote, but were not enabled to debate. The consuls and the members of the legislative body, as well as of the conservative senate, were not responsible for their conduct, but ministers of state employed by them were understood to be accountable. The committees which framed the constitution, nominated the persons who were to execute the functions of government. Bonaparte was appointed chief consul, and Cambaceres and Lebrun second and third consuls. Sieyes, as formerly, declined taking any active part in the administration of public affairs, and he received, as a gratuity for his services, an estate belonging to the nation, called *Crosne*, in the department of the Seine and Oisne.

513 Bonaparte proposes to treat with Britain.

Bonaparte had not long been in possession of the reins of government, till he sent overtures for negotiating peace with the allied powers at war with France; but it is to be presumed that he did not wish for a general peace. Separate proposals were made to the different belligerent powers, no doubt with a view to dissolve the coalition; but the decrees of the convention, which declared war against all the powers of Europe, were not repealed by him. He departed from the forms sanctioned by the custom of nations in carrying on diplomatic correspondence, but addressed a letter directly to his Britannic majesty, the substance of which was contained in two questions; "whether the war, which had, for eight years, ravaged the four quarters of the globe, was to be eternal?" and "whether there were no means for Britain and France of coming to a good understanding?" Satisfactory, and we think, unanswerable replies, were made to these questions by the British ministry, who dwelt much, and very justly, on the bad faith of revolutionary rulers, and the instability of the governments of France since the subversion of monarchy. The overture transmitted to Vienna was of a similar nature, and it experienced similar treatment; but the emperor of Russia abandoned the coalition, probably on account of the shameful manner in which Suwarrow had been treated, while carrying on the war in Italy and Switzerland.

France 1800.

Bonaparte on the 7th of March sent a message to the legislative body, containing his own ideas of the conduct and designs of the British cabinet, and assuring them that he would invoke peace in the midst of battles and triumphs, and swear to fight only for the happiness of France and the repose of the world. This message was followed by two decrees; the one calling, in the name of honour, upon every soldier absent on leave from the armies of Italy and the Rhine, to join them before the 5th of April; and the other appointing a fresh army of reserve of 60,000 men to be assembled at Dijon, under the immediate command of the first consul.

About this time the belligerent powers were nearly ready for opening the campaign in Italy and on the Rhine. The Genoese republic was the only territory of any importance in Italy, which remained in the hands of the French, but the army by which they defended it was very much reduced since the preceding year, and might be considered as in a state of mutiny, from the want of pay, clothes and provisions. The Austrians eagerly wished to obtain possession of Genoa and all its dependencies, in which they could not fail to be seconded by the Genoese themselves, as they looked upon the republicans to be the destroyers of their commerce. Massena received the command of the army in Genoa, with extraordinary powers, and evinced himself to be a general of consummate abilities. Carrying a reinforcement of troops with him from Lyons and Marseilles, and reducing to order and obedience, by a judicious distribution of rewards and punishments, all whom he found ready to desert their standards, he soon found himself at the head of a force sufficient to check the progress of the Austrians, and keep the Genoese in subjection. After a number of battles had been fought, he was obliged to retire into the city, where he must soon have been compelled to surrender by famine, if General Melas had immediately blockaded it.

51[illegible] A Brit[illegible] fleet ap[illegible] pears [illegible] Genoa.

The appearance of the British fleet on the 5th of April, was the concerted signal for Melas to make an attack upon Genoa, the communication between which and France was thus cut off. Prior to the arrival of Lord Keith, a quantity of wheat and other provisions had been thrown into the city, by which means the army and the inhabitants were rescued from the consequences of immediate famine. The surrounding country was soon vanquished by the Austrians; but as the gallant Massena still lived in the expectation of supplies from France, he obstinately refused to surrender the city. General Melas having nothing to apprehend from this army blocked up in Genoa, left General Ott to continue the blockade, and went with his own forces against Sauchet, who commanded another division of the French army.

A decisive battle was fought between Ceva and St Lorenzo, ance. 300.

Lorenzo, on the 7th of May, in which the republicans experienced a total defeat, having lost 1200 prisoners, and 19 pieces of cannon. This soon obliged General Sauchet to abandon his strong position of Col di Tenda, where he left behind him four pieces of cannon and 200 prisoners; and marching on towards Nice, the Austrians drove him from one post to another, till he was finally obliged to take refuge behind the Var; by which movements General Melas became master of the whole department of the Maritime Alps. But the campaign on the Rhine did not open in such a favourable manner to the Austrians. The court of Vienna directed the archduke Charles to resign the command of the army to General Kray, who distinguished himself in such an eminent manner in Italy, during the campaign of 1799. Of his military talents there could be only one opinion, and his integrity and zeal had been sufficiently tried; but he had the misfortune not to be so *noble* as some of the other generals! It is truly ridiculous to behold men contending about trifles, when engaged in matters of such vast importance as the salvation of their country. During the most propitious days of Rome, her greatest generals were plebeians.

15 The French d..ated n.. Lo..

16 M..au refus.. to act as ..ected by ..uapa..

It could not be reasonably expected that such a discordant army, commanded by an able officer who had the misfortune not to be a *nobleman*, would ever be able to make head against the veterans of France, led on by such an extraordinary general as Moreau. The Hungarian troops, finding themselves ready to be sacrificed to the party dissensions of their officers, would not fight against the enemy. The council of war at Vienna had sent General Kray instructions at the opening of the campaign, how he was to dispose of his forces, and having no general under him to support his own opinion, he was under the painful necessity of obeying his instructions, whether he could approve of them or not. Instructions of a similar nature had been transmitted to Moreau by the chief consul, but he indignantly refused to fight under such restraints. He was no doubt conscious that his own knowledge of the military art was at least equal to that of Bonaparte, while he was infinitely better acquainted with the country, and therefore he sent a courier to Paris to acquaint the consul, that if the orders sent him were to be rigidly obeyed, he would feel it his duty to resign his command, and accept of an inferior station. He accompanied his resignation with a plan of the campaign which he had framed for himself, the propriety of which instantly struck the chief consul, and therefore he was ordered to carry on the war, according to his own judgement.

And ..ere..re ..eft ..his ..wn ..ge- ment.

General Moreau being thus wisely left to adopt and execute his own measures, crossed the Rhine, and drove the Austrians from one post to another, till Kray, finding it impracticable to adopt offensive measures with a rebellious army, with disaffected officers to command them, resolved to maintain his position at Ulm, and wait for assistance from Vienna. He was defeated at Stockach, Eugen, and Moskirch, although he exhibited fully the talents of an able general; but what talents were able to counteract the pernicious consequences of treachery? At one time, when 7000 men received orders to advance, they instantly threw down their arms. Kray too plainly perceiving that it was absolutely in vain to attempt any thing of an offensive nature, entrenched himself strongly at Ulm, commanding both sides of the Danube, which makes it a place of great importance. Moreau perceiving his intentions, resolved to try the passage of the Danube, and force him to a general engagement, by cutting him off from his magazines at Donawert. For this purpose he gave orders to Lecourbe with one of the wings of his army, to take possession of a bridge between Donawert and Dillingen, which was not effected without considerable difficulty. The Austrians having perceived, when too late, that their all was in danger, disputed every inch of ground with the French commander. Between the time of marching to, and of crossing the Danube, Kray sent reinforcements to the left bank to oppose the passage, in consequence of which a battle was fought at Hochstet, in the vicinity of Blenheim, where victory again declared for the French, who made 4000 of the enemy prisoners, independent of the killed and wounded lost by the Austrians, of which we have seen no estimate.

France. 1800.

General Kray, sensible that his situation was perilous, left a strong garrison at Ulm, and marched against the enemy, attacking them at Newburg, which both sides conducted with determined bravery; but the Austrians, after a long contest, fell back on Ingolstadt. It may not improperly be said, that this battle decided the fate of Germany. The electorate of Bavaria was now in the possession of the French, with other territories of less extent; and as they approached the hereditary dominions of the emperor, men of republican sentiments behaved with such effrontery, as to convince the court, that no dependence could be reasonably placed on armies composed of such men. The imperial family, and the British ambassador, were openly insulted in the theatre, and the cry of *peace, peace*, was vociferated from different quarters.

The ill success of General Kray alone could not excite such a spirit, because at this time the affairs of Germany were even in a more deplorable state in Italy than upon the Danube. When the campaign opened on the Rhine, the army of reserve under the command of Bonaparte, which was formed at Dijon, began its march. When the French government declared that this army was above 50,000 strong, and receiving daily reinforcements, few could be found who were disposed to give any credit to the report. Such as were friendly to the cause of the allies, were unwilling to allow the French government so much vigour, while it was industriously circulated by the Jacobins of Germany, that it could not amount to more than 6000 men. The first consul set out from Paris on the 5th of May, to take the command of an army, the strength and destination of which had given rise to so many conjectures, and on receiving the troops cantoned at Dijon, he proceeded towards Genoa. Having been a short time in the Pays de Vaud, he joined the army of reserve at the foot of St Bernard, of which he immediately assumed the command. It is certain that a very insignificant force would have been able to arrest the progress of Bonaparte while ascending the mountain; but either General Melas had heard nothing of its being in motion, or he had implicitly believed the report of the Jacobins. In consequence of this ignorance or credulity, the army of reserve encountered no opposition till it reached the town of Aost, of which the first consul very soon

518 The French army at Dijon unexpectedly marches for Italy.

France. 1800. soon gained possession. Having, with the most astonishing perseverance, passed the fort of Bard, he proceeded on his march down the valley of Aost with little opposition, till he arrived at the town of Yorea, where the Austrians were assembled in force, but were obliged to give way before the impetuosity of the republicans, and post themselves on the heights of Romano behind the Chinsella. It was of vast importance as commanding the passage of the river, and was occupied by 4000 cavalry, 5000 infantry, and a few pieces of cannon. It was taken on the 26th of May, and the fort of Brunette soon after, in consequence of which the road to Turin was now open. While the republicans were effecting a passage over St Bernard, the chief part of the Austrians under Melas were employed in the celebration of their victory over them at Nice, little suspecting how soon they were to experience a sad reverse of fortune, and that the victors would very soon be vanquished. General Melas, at length roused from his dream of security, marched towards Turin with all possible speed, in order to defend the Po, and prevent the invaders from arriving at Vienna. He naturally concluded that Turin would be the first important point of attack made by the French, but in this he was deceived; for while he prepared to dispute the passage of the Po with the republicans, Bonaparte suddenly turned to the left, and entered Milan on the 2d of June.

The army of Bonaparte was very numerous, but he wanted magazines, artillery, and stores of every kind; but understanding that Pavia was the great depot of the Austrian army, he sent his advanced guard against it under General Lannes, who made an easy conquest of it, and found in it more than 200 pieces of cannon, 8000 muskets, 2000 barrels of gunpowder, and a prodigious quantity of all sorts of provisions. Another of the chief consul's generals crossed the Po at Stradella; and having cut off the communication between General Melas and the country of Piedmont, gained possession of the Austrian magazines at Piacenza, Cremona, and a number of other places on the banks of the river.

519 Massena in a critical situation at Genoa.

About this time it was that Bonaparte became acquainted with the fate of Genoa, by means of intercepted letters. Massena did every thing in the power of bravery and perseverance to keep possession of the city; but after he had witnessed 15,000 of the inhabitants perish with hunger, he surrendered to the British and Austrian commanders on the 5th of June, and obtained very favourable terms, when we consider that it was impossible for him to hold out any longer. The right wing of his army, consisting of 8110 men, was permitted to march into France by the way of Nice, and the rest were to be conveyed by sea to Antibes, at the expence of Britain; no man was to be deemed responsible for having held any public office under the government of the Ligurian republic; and all officers taken prisoners since the commencement of the campaign, were allowed to return to France on their parole, not to serve till they should be regularly exchanged. By the fall of Genoa, the Austrian army which besieged it was at liberty to co-operate with the commander-in-chief; and, accordingly, General Ott marched at the head of thirty battalions to check the progress of the French army in Piedmont. On the 9th of June he was met by Generals Lannes and Victor at Montebello, where a battle was fought with great fury on both sides, when the French were victorious, and General Ott retreated with great loss. Melas being unable to arrest the progress of the republicans by detachments of his army, collected his whole force between Alessandria and Tortona, that he might be able to open a way for himself to the Austrians on the Mincio, if he should find it impossible to crush the enemy. The consequence of this step was the ever memorable battle of Marengo, fought on the 14th of June, which has been variously described. The French accounts represented the army of General Melas as more numerous than that of the chief consul, to whose superior conduct and bravery alone the French were indebted for success. Others have believed that the superiority was on the side of the republicans, and think they can discover as much from comparing together the different bulletins of the army of reserve. On this point we pretend not to decide, only it is certain that the Austrians were victorious for nine hours, and the fate of that battle appears to have been decided by the masterly conduct of General Desaix, who died on the field. One false movement, made by General Melas, which enfeebled his centre, afforded the gallant Desaix an opportunity of making a vigorous charge with a body of cavalry that had hitherto been unemployed. General Zach, a man worn out with age and fatigue, when about to take the command of the army from Melas, fell into the hands of the enemy, who remained masters of the field of battle.

520 Great loss of the Austrians at the battle of Marengo.

The Austrians lost in this engagement above 9000 men, and the French upwards of 12,000, according to their own account. Enraged that the victory should be thus snatched from them, the Austrians were eager to renew the combat on the following day; but General Melas deemed it prudent to check the ardour of his troops, and concluded a capitulation, said by some to be unparalleled in the annals of war. He may have signed such a capitulation in consequence of instructions from the council of war at Vienna, or the fortresses given up by him may have been destitute of provisions. If we admit the first supposition, it follows that the council of war were determined enemies to the cause of the combined powers; and if we go upon the second, Melas himself was perhaps the most improvident commander that ever was charged with the defence of a country. The whole of Piedmont and Genoa were given up to the French, and an armistice was concluded, to last till the court of Vienna had time to return its opinion.

General Kray in Italy was anxious to avail himself of this armistice, to arrest the progress of Moreau's army: but that able general would not listen to any overtures upon the subject, till he should receive instructions from Paris. Count St Julien arrived with proposals of peace from the Imperial cabinet, in consequence of which the armistice was concluded in Germany and Italy, the posts then occupied by the respective armies being considered as constituting the line of demarcation. In opposition to the spirit of their stipulations with General Melas, the French reinforced their army in Italy, levied immense contributions, and raised troops in different states declared by themselves to be independent.

521 Great distress of the French troops in Egypt.

While France was everywhere victorious in Europe, her troops in Africa were subjected to hardships and disgrace. Their being abandoned by their chief made them

ance.
1800.

them complain bitterly; and Kleber is said to have declared, that the same *universe* should not contain him and Bonaparte. He continued the negotiations begun by General Bonaparte with the grand visier for evacuating Egypt, between whom a convention was concluded on the 24th of January 1800, to which Sir Sidney Smith agreed on the part of Great Britain. By virtue of this convention, the republican army, its baggage and effects, were to be collected at Alexandria, Rosetta, and Aboukir, to be conveyed to France in vessels belonging to the republic, and such as might be furnished for that purpose by the Sublime Porte. It would seem that nothing could have happened more injurious to the interest of the allies than the evacuation of Egypt upon such terms, since the consul would thus have been furnished with nearly 18,000 troops, which might have been advantageously employed, either in Italy or on the Rhine. It is strange how this important circumstance did not occur to Sir Sidney Smith, and no less so, how he took upon him the office of plenipotentiary. Mr Dundas clearly proved in the house of commons, that he exceeded any power with which he could reasonably conceive himself vested, that being lodged with Lord Elgin at Constantinople.

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In the latter end of the year 1799, the British ministry had reason to believe that a negotiation would take place between the grand visier and General Kleber, respecting the evacuation of Egypt by the troops of the latter; and as such an event was much to be desired, Lord Keith received orders to accede to it, on condition that General Kleber and his army should be detained as prisoners of war, instead of being sent back to France. This was bitterly complained of in France, and numbers even in England exclaimed against it as a flagrant breach of faith, while General Kleber himself did not consider it in such a light, although the only person who had reason to do so, could he have done it with fairness. On the 20th of March he attacked the Turks in the vicinity of Cairo, who fled before him in all directions, and left more than 8000 men dead and wounded on the field of battle. By this conquest Cairo was restored to the French, which in terms of the convention they had abandoned. Kleber again proposed to evacuate Egypt, on the terms agreed to by the grand visier and Sir Sidney Smith, and Lord Keith being ordered to agree to them by the cabinet of St James's, a suspension of hostilities took place, and the Turks were ready to be delivered from enemies whom they were not able to expel, when General Kleber was suddenly assasinated.

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Both parties had reason to regret this event, as General Kleber appears to have been, not only the most honourable, but by far the ablest commander of the republicans, in that quarter of the globe. It is not certainly known by whom he was murdered, nor who were the contrivers of such a plot; but at Constantinople his successor Menou was strongly suspected. We must confess that he was not friendly to Kleber; but on the other hand we do not find General Reynier, in his "State of Egypt," insinuate any thing of this natnre against Menou, although he treats his conduct and abilities with some degree of contempt; and we are informed that the assassin himself, previous to his execution, solemnly acquitted Menou from being in the least acquainted with the plot.

France.
1801.

524
General Abercromby sails for Egypt.

As Menou refused to leave Egypt by capitulation, the British government formed the resolution of driving him out of it by force. Sir James Pulteney received the command of 12,000 men, to act in the Mediterranean in such a manner as might most effectually annoy the enemy; a plan which was disconcerted by the issue of the battle of Marengo. He was superseded by Sir Ralph Abercromby, who carried reinforcements along with him, together with a train of artillery from Gibraltar. He touched at Minorca and Malta, from whence he steered his course for the coast of Egypt, which he reached on the 1st of March 1801, and anchored next day in the bay of Aboukir; but the weather prevented him from attempting to land till the 7th of that month, at 10 o'clock in the forenoon. The first division effected a landing in the face of the French, to the amount of 4000 men, whose position was so very advantageous, that an eye witness thought they might have resisted the world; yet 2000 British troops drove them from it with the loss of some field pieces, and the disembarkation was continued during that and the following day.

525
The French conquered by the British near Alexandria, and General Abercromby mortally wounded.

The whole army of General Abercromby moved forward on the 12th, and coming in sight of the main body of the French, gave them battle on the 13th. The conflict was obstinate on both sides, and their loss very considerable, but victory in the end declared for the British. This advantage was followed up with vigour, and on the 21st a more interesting battle was fought with similar success, about four miles from the city of Alexandria. Sometimes the French had the advantage, and sometimes the British, but the latter were finally victorious. General Abercromby, that he might not damp the ardour of his troops, concealed for two hours the anguish of a mortal wound he received in this action:—a degree of magnanimity which has very seldom been equalled, and we believe never was surpassed. The loss of the British on this occasion was estimated at 1500, and that of the French at 4000 men.

526
The Northern Confederacy.

As it may be said that the fate of Egypt was decided in a great measure by these two battles, we beg leave to call the attention of our readers to affairs of great importance which about this time took place in Europe. The powers of the north, envious of the superiority of Britain by sea, and acting under the influence of the capricious Paul, were resolved to revive the armed neutrality of Catharine II. during the continuance of the American war, and claimed a right of trading to the ports of France, without being subjected to have their vessels searched. The ministry of Great Britain were determined to break such a confederacy; but to the astonishment of the nation they resigned at this period. Different causes have been assigned for an event which was so unexpected; but the ostensible reason was a difference in the cabinet relative to catholic emancipation. After the union of Ireland with Britain, it seems pretty clear that the minister did propose this subject in the cabinet; but his majesty, from a sacred regard to his coronation oath, put his negative upon it, in consequence of which Mr Pitt and his friends gave in their resignation. In general they were succeeded by men who had countenanced their administration during the war. Mr Addington was appointed first lord of the treasury, and chancellor of the exchequer;

527
A change of ministry takes place in Britain.

France 1801.

chequer; Lord Eldon, lord high chancellor; the earl of St Vincent, first lord of the admiralty; Lord Hawkesbury and Pelham, secretaries of state, and the honourable Colonel Yorke, secretary at war. The former ministry was dissolved on the 11th of February; but owing to the indisposition of his majesty, none of the new ministry entered upon office before the middle of March, during which eventful interval Mr Pitt and his associates had the chief management of public affairs. The new ministry entered upon office by solemnly pledging themselves to the nation, that they would employ their united efforts in procuring a safe and honourable peace with France, while they never lost sight for a moment of the warlike plans of those who had preceded them.

About this time the most hostile measures were adopted by the powers composing the northern confederacy. The free city of Hamburgh was taken by a Danish army under Charles prince of Hesse, in order to injure the commerce of Great Britain; and the king of Prussia sent a numerous army into the electorate of Hanover. To punish this unaccountable conduct, and dissolve the northern confederacy, a fleet of 17 sail of the line, four frigates, four sloops, and some bomb vessels, was fitted out in the ports of Britain, which sailed from Yarmouth on the 12th of March, under the command of Admiral Sir Hyde Parker, Lord Nelson, and Rear-admiral Graves, and having passed the Sound, appeared before Copenhagen on the 30th of the same month. The Danes did not appear in the smallest degree agitated, for it was impossible to molest either the fleet or the city, without passing through a channel so extremely intricate, that it was once believed hardly safe to attempt it with a single ship, and without any enemy to oppose. This channel was sounded by Lord Nelson, who undertook to conduct a large division of the fleet through it, requesting from Sir Hyde Parker the command of it, which was accordingly given him, and Rear-Admiral Graves was his second in command.

528 The Danes vanquished by Lord Nelson at Copenhagen.

As the largest ships drew too much water for being employed in such a hazardous attempt, his lordship selected 12 of from 74 to 50 guns, together with four frigates, four sloops, two fire-ships, and seven bombs. A most prodigious force was opposed to this, consisting of six sail of the line, 11 floating batteries, each mounting from 26 twenty-four pounders to 18 eighteen pounders, one bomb-ship, and a number of schooners. These were supported by the Crown islands, mounting 88 pieces of cannon; by four sail of the line, moored in the mouth of the harbour, and by a few batteries on the island of Amak. Lord Nelson attacked this tremendous force on the 2d of April, and silenced the firing of the batteries after an obstinate and bloody action which lasted four hours, taking, burning, and sinking about 17 sail, including seven sail of the line. In killed and wounded the British lost 943 men, while that of the Danes must have been at least double the number. A suspension of hostilities was the immediate consequence of this brilliant victory, and a treaty of armed neutrality to last for 14 weeks.

529 Who sails from thence to Carlscrona.

After repairing the ships that were damaged upon this occasion, the British fleet sailed for Carlscrona, and appeared before it on the 19th of April. The governor here was immediately informed by the British admiral of what had happened at Copenhagen, requesting his Swedish majesty to give an explicit answer whether he meant to adhere to, or abandon the confederacy. The reply was very ambiguous; but having received the news of the sudden death of the emperor Paul, on the 23d of March, and Lord Nelson, now commander in chief, writing in a more peremptory tone than the officer whom he had superseded, the court of Stockholm deemed it prudent to follow the example of that of Copenhagen. Alexander, the son and successor of Paul, possessed of more honour and justice than his father, restored all the British property which he had confiscated, relinquished his absurd claim to the island of Malta, and agreed that neutral vessels should be searched, when bound for any one country at war with another, which proved the grave of the northern confederacy.

When the armistice was signed between the Austrian and French generals in the year 1800, the troops of the latter were in possession of Germany almost to the banks of the Inn, and of Italy to the frontiers of Venice; but the spirit of the emperor was yet unsubdued, and he would not abandon his allies by a confirmation of the preliminaries of peace which Count St Julian had agreed to at Paris, as he exceeded the powers with which he was entrusted. Kray having retired from service, the archduke John succeeded him, with whom the emperor in person repaired to the army; but they soon found it impracticable to act an offensive part against General Moreau, and therefore another armistice, comprehending Italy, was agreed to. The emperor wished to include Britain in any treaty with France, but as Bonaparte would admit no plenipotentiary from that country without the benefit of a naval armistice, which it was truly absurd to expect, General Moreau received orders to go on with his military operations.

53[illegible] The A[illegible] trians tally r[illegible] at Ho[illegible] linden.

The army of Austria was now given to the command of generals whose very names were almost unknown beyond the confines of their own country, and who evinced themselves but very little acquainted with the military art. As Moreau was pondering on the plan of his winter campaign, the right wing of his army was attacked by the Austrians with such vigour, as had nearly reduced him to the necessity of acting on the defensive; and had General Klenau known how to make a temperate use of his victory on this occasion, the ruin of the French commander would have been inevitable. The case was otherwise. Elated with his success, he unaccountably abandoned his position on the Inn, and engaging his cautious and able antagonist at the village of Hohenlinden, was totally routed, with the loss of 80 pieces of cannon, 200 caissons, and 10,000 prisoners, independent of a prodigious number left dead on the field.

General Moreau allowing the enemy no time to rally, proceeded directly towards the Inn, crossing it on the 9th of December, 1800, and driving his enemies before him, struck the court of Vienna with consternation and dismay. Prince Charles was recalled to the command of the army, but after many fruitless efforts to retrieve its lost honour, he proposed an armistice on the 27th of December, which was granted by the French commander, on condition that it should be be immediately followed by a definitive treaty. If the archduke could have had any dependence on his army, although very much weakened, this armistice, in all probability, would not have taken place, for the position of Moreau was perilous in the extreme. In the very heart of Austria, he had behind him on his right, about 30,000 men in the Tyrol, with upwards of 50,000 on his left. But Austrian valour was now almost extinguished by so many sad reverses of fortune, and Austrian officers were not true to their trust.

531 T[rea]ty of L[une]ville.

This armistice was followed by a treaty of peace signed at Luneville on the 9th of February 1801, between the emperor for himself and the Germanic body, and the first consul of the French republic, in the name of the people of France. By it the emperor ceded the Brisgau to the duke of Modena, for the territories lost by that prince in Italy, and bound himself to find indemnities in the Germanic empire for all those princes whom the fate of war had deprived of their dominions. The grand duke of Tuscany was to renounce his dukedom for ever, with its dependencies in the isle of Elba, to the infant duke of Parma, for which the empire was to furnish him with an adequate indemnification.

On the 28th of March a treaty of peace was concluded between the French republic and the king of the Two Sicilies, by which his majesty obliged himself to shut all the ports of Naples and Sicily against ships of every description belonging either to the British or the Turks, till these powers should conclude a treaty with the French republic, and till Britain and the northern powers should come to a good understanding. He renounced for ever Porto Longano in the isle of Elba, his states in Tuscany, and the principality of Piombino, to be disposed of in such a manner as the French republic might think proper.

[5]32 Br[itai]n deser[ted] by al[mo]st all Eu[rop]e.

Great Britain had now none to assist her in the contest with France, but the Turks in Egypt and the Portuguese in Europe, powers which rather diminished than increased her strength, by dividing it. The Spaniards had made an attack upon Portugal at the desire of France, conquering some of its provinces; but a treaty of peace was concluded between them on the 6th of June, by which the king of Spain restored all his conquests except the fortress of Olivenza, and the prince regent of Portugal and Algarva promised to shut the ports of his whole territories against the ships of Great Britain, and to make indemnification to his Catholic majesty for all losses and damages sustained by his subjects during the war.

[5]33 Bo[na]parte thr[eat]ens to i[nv]ade Bri[tai]n.

When the chief consul had made peace with all his other enemies, he threatened Great Britain with an immediate invasion, which gave great uneasiness at first to a considerable part of the nation, but it gradually subsided. In order to diminish this alarm, Lord Nelson was sent to destroy the shipping and harbour of Boulogne. His success in this undertaking fell short of the expectations which many had formed; but he made such an impression on the enemy on the 4th of August, as evinced that Britain could annoy the coast of France with greater facility, than France could molest that of Britain. It was also highly satisfactory to find that the spirit of the British navy was not exclusively attached to the hero of the Nile; for Rear-admiral Saumarez having, in the month of July, come up with a combined squadron of French and Spanish ships of war bound for Cadiz, much superior to his own, he scrupled not to give them battle, the consequence of which was, that one of them was captured, and two more were burnt.

534 Britain attempts to treat with France.

Attempts were again made by Britain during the summer of 1801, to negotiate with France. The first consul could not but see, from the total dissolution of the northern confederacy, that it was impossible for him to ruin the British commerce, and consequently that all the treaties he had made for the purpose of excluding our ships from neutral ports would signify nothing. He seemed determined, however, to keep possession of Egypt; and Britain, on the other hand, was as fully resolved to wrest it from him. On this account the negotiations were protracted, till the conquest of that country was known at London and Paris.

535 Rosetta, Cairo, and Alexandria, taken by the British.

When Sir Ralph Abercromby died, General Hutchinson succeeded to the command of the British forces in Egypt, who was probably acquainted with the plan of his much lamented predecessor, as one spirit seemed to actuate both. Rosetta soon surrendered, which was followed by the conquest of Cairo; and Menou having accepted of similar terms for Alexandria, the whole of Egypt fell into the hands of the allies, and the republican troops and baggage were conveyed to the nearest French ports in the Mediterranean, in ships furnished them by the allies. After these events, the negotiations between Britain and France went on more agreeably; and, on the 1st of October, the preliminaries of peace were signed at London by Lord Hawkesbury on the part of his Britannic majesty, and M. Otto on that of the French republic. By it Great Britain engaged to give up all the conquests made during the continuance of the war, excepting the islands of Ceylon and Trinidad. France was to restore nothing. The Cape of Good Hope was to be free to all the contracting parties; the island of Malta was to be given to the knights of the order of St John of Jerusalem; Egypt was to be given to the Ottoman Porte; Portugal was to be maintained in its integrity, except what was ceded to the king of Spain by the prince regent; Naples and the Roman states were to be evacuated by the French, Porto Ferrajo by the British, with all the ports and islands occupied by them in the Mediterranean; and plenipotentiaries were appointed to meet at Amiens, for the purpose of drawing up and signing the definitive treaty. This was concluded on the 22d of March 1802, in consequence of which the French republic was acknowledged by the whole of Europe.

536 Peace concluded at Amiens between Britain and France.

The restoration of peace, after so long and sanguinary a contest, gave the highest satisfaction to all ranks and denominations of men, with the exception, perhaps, of a few interested individuals; and it was certainly as honourable to Britain as could be well expected from the nature of the war. It was celebrated at Paris, in the cathedral of Notre Dame, with great pomp and magnificence. The celebration of the re-establishment of the Catholic religion in France, to which the majority of the people were warmly attached, gave additional importance to the scene in that country, and the measure evinced the most consummate political wisdom on the part of Bonaparte, whose popularity in consequence of it was very much increased. We shall now notice a few of

France. 1802. of the leading articles in the celebrated *Concordat*, or convention concluded between Bonaparte and the pope, by which the Catholic faith was again established in that country, dated 10th September 1801, and a few of the regulations established for the government of the Protestant churches.

By the regulations established for the government of the Catholic church, it is settled that no bull, rescript, decree, provision, or any thing in the place of a provision, or, in short, any other dispatch from the court of Rome, even though it should relate to individuals only, shall be received, published, printed, or otherwise put in force, without the authority of the government, and that no individual, assuming the character of nuncio, legate, vicar, or apostolic commissary, or whatever other appellation he may assume, shall be allowed to exercise his functions in France, but with the consent of the government, and in a manner conformable to the liberties of the Gallican church. The decrees of foreign synods, or even of general councils, are not to be published in France before the government shall have examined their form, their conformity to the laws, rights, and privileges of the French republic, and whatever might in their publication have a tendency to alter or to affect public tranquillity. No national or metropolitan council, no diocesan synod, no deliberative assembly, is allowed to be held without the express permission of government.

The archbishops consecrate and instal their suffragans, and watch over the maintenance of doctrine and discipline in the dioceses dependent on their see. No person can be named a bishop who is not a Frenchman, and at least thirty years of age. He must undergo an examination respecting his tenets, by a bishop and two priests commissioned by the chief consul. He nominates and instals the *curés;* who are not however to make public their appointment, till their nomination has been agreed to by the chief consul. The bishops are bound to reside in their dioceses, and are not at liberty to quit them without the permission of the chief consul.

The curés are to perform no ecclesiastical functions before they have taken, in the presence of the prefect, the oath prescribed by the convention entered into between the government and the holy see. They are bound to reside in their respective parishes; and they are directly subject to the bishops in the exercise of their functions. The vicars, and the assistants performing their duties, are under the superintendence and direction of the curés. They must be approved by the bishop, and are liable to be recalled by his authority. No priest can quit his diocese to serve in another without the permission of his bishop.

The archbishops and bishops who wish to exercise the power which is given them, by establishing chapters, are allowed to make no appointment without having previously obtained the authority of the government, not only for the establishment itself, but for the number and choice of the ecclesiastics by whom they are to be formed.

All ecclesiastics are required to dress according to the French fashion, and in black. The bishops add to this costume the pastoral cross, and violet stockings. Domestic chapels and oratories, for the accommodation of individuals, are not to be established without the express permission of the government, granted on the application of the bishop.

The bishop is to concert with the prefect the means of calling the faithful to religious worship by public bells, which are to be rung on no other occasion, without the permission of the local police. The curés in the ordinary exercise of their parochial duties pray for, and cause prayers to be offered up in behalf of the prosperity of the French republic, and the safety of the French consuls.

Article 58 fixes that there shall be in France 10 archbishops and 50 bishops; and article 60. fixes that there shall be at least one parish within the jurisdiction of a justice of peace, and as many subsidiary places of worship as circumstances may require.

The salary of the archbishops is to be 15,000 francs (about 625l. sterling), and that of the bishops 10,000 francs (about 420l. sterling). The curés are divided into two classes. The salary of the curés of the first class is to be 1500 francs (about 62l. sterling); that of the second class is to be 1000 francs (about 42l. sterling.) The pensions they enjoy according to the regulations of the constituent asembly shall be deducted from their salaries. But the general councils of the larger communes are empowered to grant them an augmentation of salary, such as circumstances may require.

The principal articles relating to the Protestant religion are as follows:

No individual is allowed to officiate, as a minister of religion, who is not by birth a Frenchman; and neither the Protestant churches nor their ministers are permitted to have any connexion with a foreign power or authority. The pastors or ministers pray for the prosperity of the French republic and the safety of the consuls. No doctrinal decision or formality, under the title of a *confession*, or under any other title, is to be published or become a subject of instruction before its publication has been authorised by the government; and no change can take place in the forms of their discipline without the same authority. The council of the state takes cognizance of all the plans formed by their ministers, and of all the dissensions which may arise among them. To the support of pastors of consistorial churches, the property of these churches is to applied, as well as the obligations established by usage and by positive regulations; and they are on the same footing as the Catholics in regard to the liberty of endowments, and the nature of the property which can be the object of them.

Two academies or seminaries are appointed in the east of France for the instruction of the ministers of the confession of Augsburg; and one at Geneva for the instruction of the ministers of the reformed churches. The professors in all these academies or seminaries shall be nominated by the chief consul. No person can be elected a minister or pastor of any of these churches, who has not studied during a fixed period in one of the seminaries appointed for ministers of this persuasion, and who cannot produce a certificate in due form of his capacity and regular conduct during the continuance of his studies.

WHEN Bonaparte was elected first consul for ten years,

years, he was deemed competent to be re-elected for the same length of time; but he was afterwards chosen for life, with the strange power conferred upon him of nominating his successor, or, in other words, of governing beyond the grave, than which nothing can be conceived more ridiculous or unjust. Having advanced with such rapidity in the acquisition of power and authority, it was extremely natural to conclude, that the ambition of Bonaparte was not satiated, but that he would afterwards claim to himself, and influence an infatuated people to sanction, still higher degrees of dignity and grandeur. A book was accordingly published, either with his permission, or by his express command, pointing out the propriety and expediency of creating him *First Emperor of the Gauls!* At a subsequent period of the history contained in this article we shall see this extravagant proposition actually carried into effect, and Napoleon I. adorned with imperial honours. This verifies what Dumourier asserted concerning the French, at a time when such an event was highly improbable; "that a king they would have."

537 Bonaparte chosen consul for life.

538 The extent of his power.

In the capacity of first consul, his power was similar to that of his Britannic majesty, in respect of criminals under sentence of death, that he could grant them at his pleasure a plenary pardon, and admit them to return again to the bosom of society; but his executive authority in almost every other case was dangerously greater, as there was in fact no other power in the state which could possibly controul him. While his authority was established thus firmly within his own dominions, he endeavoured to increase his influence over the rest of Europe, by forming an alliance with the court of Petersburgh. At first it was believed to be purely of a commercial nature, but the active part taken by both in dismembering the Germanic body, clearly evinced that such an alliance was of a more interesting nature, notwithstanding the ostensible reason for such conduct was the indemnification of the sufferers during the war.

It will perhaps be admitted, that the state of France, after the dreadful convulsions occasioned by the revolution, required an executive government of considerable promptitude and vigour; yet it was surely possible, and it was no less a sacred duty binding upon him, to consult, in particular circumstances, the happiness and prosperity of the people much more than he did, without endangering in the smallest degree the stability of his government. The French people should not have been deprived of the many blessings resulting from a representative government; and if not ripe for it then, it should have been conferred upon them at a subsequent period. If the hero of Marengo was afraid of facing a free parliament, he thus pronounced himself a tyrant, and if unable to moderate its deliberations, very deficient in political knowledge. He might find it expedient, for instance, to impose some restraints on the licentiousness of the press; but totally to annihilate its liberty was as unjust as it was impolitic. He should have recollected a saying of an historian and philosopher, "that a whisper may circulate as rapidly as a pamphlet."

Towards the termination of the year 1802, Bonaparte was very active in his visitation of the sea-port towns, where the most fulsome addresses were presented to him which were ever given to any mortal being. Various conjectures were formed as to the probable design of such visits. It was thought by some that he intended to conciliate the affections of the people, especially the military and the constituted authorities; others imagined that it was to make himself acquainted with the true state of public opinion; while a third class conjectured that it was with a view to increase the navy of France, and acquire an intimate knowledge of the different parts of the coast. Whatever his object was, it is more than probable that it was directed to one point, and that his complicated movements were purposely intended to mislead those who felt an interest in watching him. It is true, he made no secret of his determination to invade Great Britain; but we should greatly diminish that knowledge which he must unquestionably possess, were we to conclude that he ever seriously believed in the practicability of such an undertaking.

His abilities as a soldier will be disputed by no man, for when viewed only in this light, he is unquestionably *great;* but it would be a most unpardonable breach of truth to call him an able politician. While he promised to restore the commerce of France, it continued to languish, more perhaps after the restoration of peace, than during the continuance of the war. This seems to be a subject fairly beyond his comprehension. Numbers in France drew a great part of their subsistence from the expenditure of such persons from the British dominions, as were disposed, after the return of peace, to pay a visit to the metropolis of the Gallic empire. But while we thus freely animadvert on the conduct of the first consul, and point out his errors or faults without any reserve, we wish not to conceal a single circumstance which redounds to his honour. When Cambaceres, the bishop of Caen, made application to the prefect of Rouen to have the Protestant churches forcibly shut; as soon as the request of the bishop was known to Bonaparte, he sent for the second consul, and told him, that if the bishop had not been *his* brother, he would have struck him off the list. Such a reply was certainly worthy of a great man.

539 Character of Bonaparte.

On the 21st of February 1803, a view of the state of France was laid before the legislative body and the tribunate, containing a comprehensive view of the relations of the republic, both with respect to colonies and foreign states; but the most important part of it had a reference to Britain, which was charged with acting improperly in retaining troops in Malta and Egypt, after the signing of the definitive treaty. It divided the inhabitants of it into two parties, representing the one as having sworn implacable enmity to France, and the other as anxious to maintain the relations of peace and amity, concluding with singular bravado, "whatever may be the success of intrigue at London, it will never force other nations into new leagues; and the French government asserts, with just pride, that England alone cannot now contend with France."

540 Hostile preparations of France.

It now began to be manifest, that the blessings of peace were not to be long enjoyed. The extensive warlike preparations going forward about this time in the ports of France and Holland, roused the jealousy of the British ministry; for although the ostensible reason was to reduce the revolted colonies to obedience, they could not help apprehending that much more was comprehended in such extensive armaments. We shall still be more inclined to adopt this opinion, if we advert to the following

France. 1803. lowing circumstance. When Bonaparte, on the 13th of March, found Lord Whitworth and M. de Marcoff standing together, he addressed them in these words: "We have fought for fifteen years, and it seems there is a storm gathering at London, which may produce another war of fifteen years more.—The king of England has said, in his message to the parliament, that France had prepared offensive armaments; he has been mistaken; there is not in the ports of France any considerable force, they having all set out for St Domingo. He said there existed some differences between the two cabinets; I do not know of any. It is true that his majesty has engaged by treaty that England should evacuate Malta. It is possible to kill the French people, but not to intimidate them." At the conclusion of the drawing-room, it is said that Bonaparte addressed the British envoy thus, when near the door: "The duchess of Dorset has passed the most unpleasant season at Paris; I most ardently wish she may pass the pleasant one also; but if it is true that we are to have war, the responsibility, both in the sight of God and man, will be on those who shall refuse to execute the treaty."

Much about the same time a paper was inserted in the *Hamburgh Correspondenten*, containing much violent declamation against Great Britain, and believed by many to have been the production of Bonaparte. If our information be correct, the French minister requested, and obtained permission, from the magistrates of that city to make it thus public. Some alterations were made on the manuscript, which having given offence to the republican ambassador, it was, on the 30th of March, inserted without any alterations or supposed amendments. It contains many rancorous expressions against Great Britain, while part of it seems to be a designed apology for the insulting conversation which took place at Madame Bonaparte's drawing room already mentioned. It contains some reflections also on the freedom of discussion indulged in the British newspapers relative to the affairs of France, a circumstance far beneath the notice of the first consul, who, in this particular, did not advert to the freedom of the British press.

In the interior parts of France, the most active preparations for war continued to be made, and at the seaports, the different commanders received orders to put the navy as fast as possible on a respectable footing. Vast bodies of the military received orders to leave the Netherlands, and march towards the frontiers of the Batavian republic, while the ships destined for the Newfoundland fishery were laid under an embargo.

541 Disputes concerning Malta.

As the island of Malta was, by the treaty of Amiens, to be surrendered to the knights of the order of St John of Jerusalem, upon certain conditions, De Thomasi, the new grand master, sent M. de Bussy his lieutenant in the month of January, with full powers to demand possession of the island; to which the governor Sir Alexander Jonathan Ball, replied, that as some of the powers who had, by the 10th article of the treaty of Amiens, been invited to guarantee the independence of Malta, had not as yet agreed to that measure, he could not terminate the government of his Britannic majesty without farther instructions.

As the long and tedious correspondence carried on between Great Britain and France, by means of Lord Whitworth and M. de Talleyrand, which was laid before both houses of parliament on the 18th of May 1803, did not terminate in such a manner as the lovers of peace most ardently wished, a fresh rupture between the two countries seemed unavoidable. Officers were sent to reside in the principal sea-ports of Great Britain, vested with the character of commercial agents, but they were in fact detected in sounding the harbours, and in drawing plans of the ports; a glaring proof that some desperate blow was meditated against this country.

542 Hostilities re-commence between Britain and France.

In spite of the efforts of the British ministry to prevent a rupture, hostilities actually commenced on the 16th of May, and letters of marque were issued against the French republic. The ultimatum of Britain was conceived in these terms: "that the French government should not oppose the cession of the island of Lampedosa to his Britannic majesty; that the French forces should evacuate the Batavian and the Swiss territory; that a suitable provision should be made for the king of Sardinia; and, by a secret article, that Britain should be permitted to retain possession of Malta for ten years." Our readers will no doubt immediately conclude, that this was rejected; but France still made some feeble endeavours to negotiate, which appearing to the cabinet of St James's to be a pretext only to gain time, the war was considered as actually recommenced. All subjects belonging to Britain who were now found in France and Holland were arrested and detained; an event which was speedily followed by the march of a republican army towards Osnaburgh and Hanover, the former of which was taken possession of by General Mortier on the 26th of May, after which he took the town of Bentheim, and the Hanoverian garrison were made prisoners of war. Osnaburgh was abandoned by the Hanoverians on the 28th, and two days after the French got possession of Quackenbrook. His royal highness the duke of Cambridge was determined to stand or fall with the electorate; but as he was at the head of no more than a handful of troops compared with the army of Mortier, the regency urged him to retire from the command, as the probability of success was entirely against him. The duke, therefore, returned to Bremen, and reached Yarmouth on the 13th of June, along with Prince William of Gloucester.

Much about this period, General Mortier was waited upon by deputies from the regency, both of a civil and military nature, who begged that he would suspend his march, and proposed a capitulation. By this the Hanoverian troops were permitted to surrender on their parole, and agreed not to take up arms against France during the continuance of the war. Sums were to be raised for maintaining the republican army, while private property was to be held sacred.

If this promise, however, was really made, it does not appear that it was considered as binding, for it has been said that more flagrant acts of cruelty and injustice were scarcely ever perpetrated by people professing to be civilized. The following, we are told, is part of the information upon this subject communicated by private letters. "In the city of Hanover, and even in the public streets, women of the highest rank have been violated by the lowest of the brutal soldiery, in the presence of their husbands and fathers, and subjected at the same time to such additional and undescribable outrages, as the brutal

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tal fury of the violators, inflamed by drunkenness, could contrive. Nor have we heard that the philosophers of Goettingen, the enthusiasts of equality and perfectibility, have been at all better treated." We suspect that this picture is too highly coloured; yet, if a thousandth part of the narration be true, of which we have only selected a specimen, we must allow it to be an indelible stigma on the French nation.

Bo parte labo s to rui ritish erce.

It had always been a favourite object with Bonaparte, to do as much injury as possible to the commerce of Great Britain, and therefore he now determined to shut against this country the ports of the Weser and the Elbe; and also insisted on the ports of Denmark being shut against vessels belonging to Britain, proposing to plant a French garrison in the city of Copenhagen, while the other powers of Europe seemed to behold his conduct with indifference or stupefaction. The French having put themselves in possession of the exclusive navigation of the Elbe, Great Britain determined to blockade it with ships of war, as a report then prevailed that Bonaparte would make use of that port for the purpose of invading Scotland. In this view of the matter, the conduct of Britain was highly commendable.

About this time the French army in St Domingo was in a most melancholy condition, as appeared from the information contained in some intercepted letters. Although about 10,000 men reached the island, in three months after General Rochambeau's arrival, when they were landed in the different ports, scarcely any traces of a reinforcement could be perceived, so much had his army suffered. The atrocities of the troops in their turn were also said to be great, and complaints made to the commanding officers were answered with threats. It appears that Rochambeau was obliged to have recourse to absolute falsehood, in order to keep up the spirits of his troops, and allay their discontent; giving out, what he knew could not be the case, that a reinforcement of 20,000 men was daily expected.

Brit put in a te of de ce.

In the mean time, the ministry of Great Britain used every effort to place the country in a secure and respectable state of defence, should the insatiable ambition of Bonaparte lead him to a serious attempt to invade it. The intelligent part of the people indeed believed that he never seriously intended to hazard the consequences of what he threatened, yet it was certainly prudent to prepare for the worst. The troops of the line were industriously and successfully recruited, the militia were called out and kept in actual service, and an army of reserve was raised with the utmost expedition. Having almost 500,000 troops of different species, Britain had no just reason to apprehend an invasion, being able to accomplish the destruction of the boldest invader. These troops were encamped along the coast, garrison towns were properly supplied with men, the greatest force was concentrated wherever the probability of a landing was strongest, and care was taken of the health of the military, as well as the appointment of the ablest generals to command them. Provisions, ammunition, and stores, were collected in abundance. As it was natural to conclude that London would be the great object with an invading army, the utmost attention was paid to the defence of those parts of the coast which are most adjacent to it.

Similar efforts were made to annoy the enemy by sea, and render their designs wholly abortive. To Lord Keith and Admiral Montagu was entrusted the command of the channel fleet; and an attempt was made at Granville to disconcert the preparations of France, by a detachment of ships under the command of Sir James Saumarez, which was so far attended with success as to intimidate the inhabitants, damage a number of houses, and destroy some boats in the harbour. Similar attacks upon Calais and Boulogne also tended to convince the French residing on the coast that they were far from being secure, although total destruction was not the consequence of such exertions. Lord Nelson then guarded the Italian seas, and Sir Edward Pellew and Sir Robert Calder were stationed off Ferrol.

545 Cruelties of the French towards the Hanoverians.

In the mean time the republican army in Hanover continued to oppress the inhabitants, and to devour the resources of that electorate. The Dutch were made to suffer almost as much from their new allies and pretended friends, as the inhabitants of a conquered country. They were dragged into a war, of which they certainly wished to be the unconcerned spectators, compelled to raise and maintain a large body of native troops, to receive garrisons into all their strong towns, to give up their sea-ports to the French, and expose their whole country as a scene of passage and encampment to the armies of the republic. Their trade was ruined, and their ports blocked up by the British at sea, on account of their alliance with France. The inhabitants of the Belgic provinces belonging to France were also severe sufferers by the levies of conscripts, the interruption which their trade and manufactures met with from the war, and the rigour by which they were governed. It was reported that the first consul had 300,000 effective men in readiness along the coast and the places adjacent, and that 2800 men were incessantly employed, augmenting and repairing the fortifications at Boulogne.

546 The British coasts are fortified.

During the month of November 1803, the sea-coasts of Great Britain and Ireland received fresh additions of strength, that if ever troops from France should dare to attempt a landing, they might be assured of meeting with a warm reception. The garrison of Plymouth was augmented to 13,700 landmen, besides 1500 seamen and marines. A battery was erected at Paul Point, for the defence of the Humber, and two others were to be built opposite to it in Lincolnshire. Exertions equally spirited were continued by sea. Sir Sidney Smith cruised off the Texel, and drove on shore on the coast of Holland, 12 armed ships of the enemy, three of which were captured. During the month of February 1804, the French and Dutch ports continued to be blockaded by the British navy with the utmost vigilance, a measure which the tempestuous nature of the weather frequently rendered hazardous. The preparations for an invasion of this country were still continued on the part of France, but no force of any consequence found it practicable to put to sea, owing to the vigilance of our cruisers. A number of gun-boats were taken at different times off Boulogne, and different other parts of the French and Dutch coasts, which might have convinced the people of these countries of the absurdity of expecting to accomplish any thing decisive against Britain by such inadequate means.

A plan was suggested for filling up the ports of the enemy with stones and the hulks of old vessels, so as to render it difficult, if not wholly impracticable, either for ships or small craft to make their way out of

them.

France.
1804.

them. The idea seems to have been taken from a fact well known, that harbours have been often ruined by the tides and currents of the sea, the deposition of sand from rivers, earthquakes, and other accidents; and therefore it was concluded that similar effects might be produced by artificial means. The accomplishment of such an object, if it were practicable, would be an ample compensation for the greatest expence.

It was the opinion of the discerning part of mankind long before it happened, that the ambition of Bonaparte would not always remain satisfied with the dignity of first consul, even for life; for although he could receive no fresh additions to his power and influence, yet there was reason to believe that the sound of such titles as have always been deemed higher and more dignified still, would be too fascinating for him to resist. Accordingly, on the 25th of April 1804, the following decree was issued by the tribunate of France.

"The tribunate, considering that at the breaking out of the revolution, when the national will had an opportunity of manifesting itself with the greatest freedom, the general wish was declared for the individual unity of the supreme power, and for the hereditary succession of that power:

"That the family of the Bourbons, having by their conduct rendered the hereditary government odious to the people, forced them to lose sight of its advantages, and drove the nation to seek for a happier destiny in a democratical form of government:

"That France having made a trial of different forms of government, experienced from these trials only the miseries of anarchy:

"That the state was in the greatest peril, when Bonaparte, brought back by providence, suddenly appeared for its salvation:

"That the consulship for life, and the power granted to the first consul of appointing his successor, are not adequate to the prevention of intrigues at home or abroad, which could not fail to be formed during the vacancy of the supreme power:

"That in declaring that magistracy hereditary, conformity is observed at once to the example of all great states, ancient or modern, and the first wish of the nation, expressed in 1789:

"That, enlightened and supported by this experience, the nation now returns to this wish more strongly than ever, and expresses it on all sides:

"That when France demands for her security an hereditary chief, her gratitude and affection call on Bonaparte:

"That France may expect from the family of Bonaparte, more than from any other, the maintenance of the rights and liberty of the people:

"That there is no title more suitable to the glory of Bonaparte, and to the dignity of the supreme chief of the French nation, than the title of emperor.

"The tribunate have come to the following vote:

"That Napoleon Bonaparte, the first consul, be proclaimed emperor of the French, and in that capacity be invested with the government of the French republic:

"That the title of emperor and the imperial power be made hereditary in his family in the male line, according to the order of primogeniture."

The foregoing decree having been put to the vote, it was carried by acclamation, with the single exception of the only member (Carnot) who delivered his sentiments against its adoption.

The senate presented an address to the first consul, in which they took great pains to convince him that the safety of France, and the happiness of Europe, depended entirely upon his acceptance of the title of Emperor of the French, and upon its being made hereditary in his illustrious family. The different divisions of the army of course sent addresses to the first consul, intreating him to condescend to become emperor of France.

Bonaparte requested them, in his answer, "to make known to him the whole of their thoughts." The senate then desired him to take the imperial and hereditary dignity. Bonaparte consented.

An address was presented by the senate to the first consul, in which they employed many arguments to convince him (they might have spared themselves the trouble) that the preservation of France, and the repose of all Europe turned on his acceptance of the dignified title of the emperor of the French, which right to be hereditary in his august family. The different divisions of the army hoped also that he would be graciously pleased to *condescend* (what an instance of humility!) to become emperor of France. Whether or not it may excite the astonishment of our readers, we can assure them upon the most undoubted authority, that he was so *humble* as to accept of it, and the following is his address to the conservative senate.

"Senators,

"Your address of the 6th last Germinal has never ceased to be present to my thoughts. It has been the object of my most constant meditation.

"You have judged the hereditary power of the supreme magistracy necessary, in order to shelter the French people completely from the plots of our enemies, and from the agitations which arise from rival ambitions. It even appears to you, that many of our institutions ought to be improved, in order to secure for ever the triumph of equality and public liberty, and present to the nation and to the government the double guarantee they are in want of.

"In proportion as I fix my attention upon these great objects, I am still more convinced of the verity of those sentiments which I have expressed to you, and I feel more and more, that in a circumstance as new as it is important, the counsels of your wisdom and experience were necessary to enable me to fix my ideas.

"I request you then to make known to me the whole of your thoughts.

"The French people can add nothing to the honour and glory with which it has surrounded me; but the most sacred duty for me, as it is the dearest to my heart, *is to secure to its latest posterity* those advantages which it has acquired by a revolution that has cost it so much, particularly by the sacrifice of those millions of brave citizens who have died in defence of their rights. Fifteen years have past, since, by a spontaneous movement you ran to arms, you acquired liberty, equality, and glory. These first blessings of nations are now secured to you for ever, are sheltered from every tempest, they are preserved to you and your children; institutions conceived and begun in the midst of the storms of interior and exterior wars, developed with constancy, are just terminated in the noise of the attempts and plots of our

our most mortal enemies, by the adoption of every thing which the experience of centuries and of nations has demonstrated as proper to guarantee the rights which the nation had judged necessary for its dignity, its liberty, and its happiness."

The new emperor was allowed to adopt the children or grand-children of his brothers, if arrived at the age of 18 years complete, and he without legitimate children of his own; but this privilege cannot be enjoyed by his successors. Failing both legitimate and adopted heirs, the crown shall be enjoyed by Joseph Bonaparte and his descendants; and failing Joseph and his descendants, it shall devolve on Louis Bonaparte and his descendants, &c. If a successor cannot be found in any of these channels, a *Senatus consultum*, proposed to the senate by the dignities (we presume it should have been dignitaries) of the empire, and submitted for the acceptance of the people, shall nominate an emperor. It was also decreed that the members of the imperial family should be called French princes, and the eldest son of the family, the imperial prince. Amongst other things it was enacted, that every emperor, two years after he comes to the throne, shall swear to maintain the integrity of the territory of the French republic! We have mentioned this last circumstance, wholly for this reason, that *the emperor of a republic* is no doubt a rarity to the greater part of our readers.

Tria[l] of state pri-soners in France.

The trial of the state prisoners commenced at Paris on the 29th of May 1804. They were charged with conspiring against the life and government of Bonaparte; but how great was our astonishment to find the justly celebrated General Moreau included in the number! Envy and jealousy of Bonaparte can alone have implicated this great man in such a charge, as he was heard to say on the arrival of the new emperor from Egypt;—"this is the man who is necessary to save France." Georges with 11 of his associates, were condemned and executed on the 25th of June; the gallant Moreau and four more, were sentenced to suffer two years imprisonment, and about 18 were acquitted. Some of those who were condemned were afterwards pardoned by imperial clemency, moved by the fascinating charms of female eloquence and female tears. The sentence of imprisonment against Moreau was commuted to banishment for life to the United States of America.

5[49] Coronation of Bonaparte.

The coronation of Bonaparte took place in the month of December 1804, which was accompanied on the part of the people by such demonstrations of apparent satisfaction as evinced the degraded state of the public mind in that unfortunate country. After receiving a number of the most fulsome speeches, filled entirely with bombast and falsehood, his imperial majesty delivered the following address. "I ascend the throne, to which the unanimous wishes of the senate, the people, and the army have called me, with a heart penetrated with the great *destinies* of that people, whom, from the midst of camps, I first saluted with the name of Great. From my youth, my thoughts have been solely fixed upon them (so it appears); and I must add here, that my pleasures and my pains are derived entirely from the happiness or misery of my people. My descendants shall long preserve this throne (a very bold prediction). In the field they will be the first soldiers of the army, sacrificing their lives for the defence of their country. As magistrates they will never forget, that contempt of the laws, and the confusion of social order, are only the result of the imbecility and uncertainty of princes. You, senators, whose counsels and support have never failed me in the most difficult circumstances, your spirit will be handed down to your successors. Be ever the prop and first counsellors of that throne, so necessary to the welfare of this vast empire."

550 Who writes a letter to his Britannic majesty on the subject of peace.

On the 4th of February 1805, a letter written by Bonaparte to his Britannic majesty on the subject of peace, was laid before the legislative body by the counsellors of state, in which he observed that providence, the senate, the people, and the army, had called him to the throne of France. He admitted that the two countries, over which they presided as the chief magistrates, might contend against each other for ages, but denied that it was for the interest of either to continue the contest. He requested his Britannic majesty not to deny himself the inexpressible felicity of giving peace to the world; for should the present moment be lost, he did not see how all his efforts would be able to terminate the war, which he considered as without any object or presumable result. He concluded with observing, that reason is sufficiently powerful to discover means of reconciling every thing, when the wish of reconciliation exists on both sides. On the 16th of the same month, a very splendid entertainment was given to the emperor and empress by the city of Paris.

551 The memorable battle of Trafalgar, in which Lord Nelson fell.

Never was any naval victory more glorious or decisive than that which was gained by the British under Vice-admiral Lord Nelson over the combined fleets of France and Spain, off Cape Trafalgar, on the 21st October 1805. The British commander in chief gave the signal for bearing up in two columns as they formed in the order of sailing, a mode of attack which had been previously ordered by his lordship, to prevent the delay and inconveniency of forming the line of battle in the manner usually adopted. The fleet of the enemy consisted of 33 ships, under the command of the French admiral Villeneuve. The Spanish division under Admiral Gravina, formed the line of battle with great coolness and skill, the heads of the ships being turned to the northward. The manner of attack was uncommon, and the formation of their line was consequently new. Few signals were necessary from the commander of the British fleet, because the flag officers and captains were made previously acquainted with the admiral's whole plan. The weather column was led by the commander in chief, on board the Victory, and Lord Collingwood in the Royal Sovereign took charge of the leeward division. The leading ships of the British columns breaking through the enemy's line, was the signal for commencing hostilities, which began about 12 o'clock. The ships of the enemy were fought in such a manner as did the highest honour to the officers by whom they were commanded, but they opposed a force which was not to be vanquished. About 3 o'clock in the afternoon the enemy's line gave way, many of their ships having struck their colours. Admiral Gravina then steered for Cadiz; and 19 sail of the line, of which two were first rates, fell into the hands of the victors, and three flag-

France. 1805.

552 Germany is overrun by Bonaparte.

flag-officers, Villeneuve, Don Ignatia Maria d'Aliva, and Don Baltazar Hidalgo Cisneros, were made prisoners.

About the same time that the British navy acquired the most signal victory over the combined fleets of France and Spain, the emperor Napoleon was carrying his victorious arms through the heart of Germany, and forcing the emperor of that country to abandon his metropolis. He left Paris on the 24th of September 1805, to join the grand army, and reached Strasburg on the 26th, accompanied by the empress. Here he issued a manifesto to his army, in which he mentioned the commencement of the war of what he termed the *third coalition*, which he said was created and maintained by the gold and hatred of England. He declared he would fight till he had secured the independence of the Germanic body, and never again make peace without sufficient security of its continuance. He crossed the Rhine at Kehl on the 1st of October, and on the evening of the same day arrived at Ettlingen, where the elector of Baden was presented to him, along with his two sons. On the 2d he went to Stutgard, where the elector (now king) of Wirtemberg received him in the most magnificent manner, and the city was illuminated. The king of Wirtemberg agreed to furnish 6000 men for the assistance of France, and the elector of Baden 4000.

The French armies on the coast reached the banks of the Rhine in the month of September, and crossed that river on the 25th. General Bernadotte reached Franconia on the 23d, where he was joined by the Bavarian army of 20,000 infantry and cavalry; by the army of Holland under Marmont, and the Batavian division. This army of Bernadotte, about 40,000 strong, constituted the fifth division of the grand or imperial French army. It is remarkable that these three great men, Jourdan, Lecourbe, and Macdonald, were not employed; the reason assigned for which measure is, that Bonaparte suspected them of disloyalty ever since the condemnation of that singular officer Moreau. Bernadotte marched directly for the Danube on the 2d of October, and took a position at Ingolstadt. The rapidity with which the French forces moved seems to have disconcerted the Austrian commander completely, as no movements were made to oppose their progress.

Hostilities commenced on the 7th, when the Austrians were defeated with the loss of many killed, wounded, and prisoners, in attempting to oppose the passage of General Vandamme across the bridge of Donawert. Field-marshal Auffenberg, while on his march to Ulm, was completely surrounded by the French, and obliged to surrender. It is said that the Austrians here lost two colonels, five majors, 60 officers, and 4000 men made prisoners. Memmingen surrendered on the 14th to Marshal Soult, after which he marched on to Biberach, in order to cut off the retreat of the Austrians by that road. Marshal Ney crossed the Danube, and made an attack upon Elchingen a little above Ulm. The Austrians made a sortie, but were driven back to their entrenchments before Ulm, with the loss, it is said, of 3000 men taken prisoners; and at Langenau their loss amounted to the same number, in an action with Prince Murat, who commanded the cavalry. This officer again brought them to action on the 17th, when their loss was computed at 1000 men, and next day General Werneck's division was obliged to capitulate. From Albeck to Nuremberg, Murat is said to have got possession of 1500 waggons and 16,000 prisoners; but Prince Ferdinand effected his escape.

Ulm surrendered by capitulation on the 17th, and this unaccountable step was taken by General Mack, because Berthier assured him that the Austrians were on the other side of the Inn; that Lannes was in pursuit of Prince Ferdinand; that Werneck had capitulated, and that it was impossible for any succours to reach Ulm. After the surrender of this place, the Austrian generals who were made prisoners, were sent under an escort through Bavaria to Vienna, and Mack was entrusted with some proposals to the emperor of Germany.

On the 28th of October a spirited proclamation was issued by the emperor at Vienna, declaring that the views of Austria and Russia were extremely moderate, and execrating the designs and views of Bonaparte. Every division of the French army, except that under General Ney, crossed the river Inn on the 1st of November. Bonaparte himself was with the right wing at Saltsburg; and the centre, commanded by Prince Murat, marched towards Lintz with uncommon rapidity. The Austro-Russian army retreated to Maelk (50 miles from Vienna) as the enemy advanced. The Austrians and Russians made no stand between the Ens and Vienna, which latter place the French entered on the 12th of October. Bonaparte arrived on the 13th, and took up his quarters in the palace of Schoenbrun, about two miles from the city of Vienna. The French troops conducted themselves with the utmost propriety and decorum, which prevented any disturbance from taking place in the metropolis.

On the 27th November, as Bonaparte perceived the dreadful carnage which was inevitable from the conflict of two such prodigious armies as that of the allies and his own, was extremely anxious to spare the effusion of human blood, and for this purpose he proposed an armistice, which was rejected with disdain. It was not long before Bonaparte discovered that the allies were acting from presumption, want of consideration, and imprudence, of which circumstance he was but too well qualified to take advantage. At sunrise the battle commenced, and a tremendous cannonade took place along the whole line. It is almost needless to remark, that 200 pieces of cannon and 200,000 men made a most tremendous noise. In less than an hour the whole left wing of the allies was cut off, their right being by that time at Austerlitz, the head quarters of the Russian and Austrian emperors. From the heights of this place the emperors witnessed the total defeat of the Russians by the French guard. The loss sustained by the allies during the whole of this battle was estimated at 150 pieces of cannon, with 45 stand of colours, and 18,000 Russians, and 600 Austrians were left dead on the field. On the 5th of December an interview took place between the emperors of Austria and France, which lasted for two hours. An armistice was mutually agreed to, which was to serve as the basis of a definitive treaty. The emperor of Russia was comprehended in this armistice, on condition of marching home his army

France. 1806.

army in such a manner as the emperor Napoleon might think proper to prescribe. By virtue of the treaty of peace, the French agreed to evacuate Brunn on the 4th of January, Vienna on the 10th, and the whole Austrian states in six weeks after the signing of the treaty, except such as were ceded to Italy and Bavaria.

From the humbled situation of the emperor of Germany after the memorable battle of Austerlitz, it was natural to expect that he would feel it his interest to make peace with the French emperor, and accordingly the treaty of Presburg was signed and ratified on the 26th and 27th of November, 1805. By this treaty, Austria gave up the Venetian territories both in Italy and Dalmatia, with the islands in the Adriatic. She acknowledged Napoleon as emperor of the French and king of Italy, and acknowledged also the new royal titles of the princes of Bavaria and Wirtemberg.

A fleet which escaped from Brest in the end of 1805, had the bad fortune which usually attended the French maritime expeditions. It consisted of eleven sail of the line and some frigates; and a part of it under Admiral Le Seigle, after disembarking some troops and ammunition at St Domingo, was destroyed or taken by Admiral Sir J. Duckworth in Ocoa bay. The other division of the fleet under Admiral Villaumez, which was destined for the Cape of Good Hope, having learned the capture of that colony, sailed first to Brazil, and afterwards to the West Indies, and the coast of North America, where some of the vessels were shipwrecked, others taken by the British; and of the whole eleven sail of the line, the Castor only, with Jerome Bonaparte on board, returned to France. About the same time the Marengo and Bellepoule French ships of war, which had committed great depredations in the East Indies, were taken by Sir J. B. Warren near the Mauritius.

In August 1805, an expedition, consisting of about 5000 land troops, with a proportional naval force, under Sir David Baird and Sir Home Popham, sailed from England for the Cape of Good Hope, and disembarked in Saldanha bay on the 4th January 1806. The army having advanced, defeated the Dutch force on the 8th, and shortly after terms of capitulation were proposed by General Jansens. This important settlement with all its dependencies was given up to the British, and the Dutch army was sent to Holland at the expence of the British government.

The reduction of the Cape was followed by another expedition, the first result of which produced an extraordinary sensation in Great Britain. Sir Home Popham had formerly been entrusted with some schemes formed by the British government against the Spanish possessions in South America, but which had subsequently been abandoned. Thinking, however, that success would cover the crime of disobedience, and perhaps stimulated by the prospect of private gain, he carried away the whole naval force from the Cape, and persuaded Sir David Baird to supply him with a small body of troops. He sailed to the Rio Plata, and disembarked his small army of 1600 men, about 12 miles from Buenos Ayres on the 25th June 1806. The Spanish regular troops being all at Monte Video and Maldonado, the town was defended only by the militia, who retired and left it open to the British almost without the least shew of resistance. The news of the capture of the place, accompanied by a very exaggerated account of the advantages of the colony as a market for British manufactures, spread the most extravagant joy through Great Britain, and led to a multitude of ruinous mercantile speculations. The Spaniards had been surprised rather than conquered. Seeing the small amount of the British force, they drew a body of troops from Monte Video, armed the country population, and assisted by a conspiracy within the town, they attacked the British on the 12th August, compelled them to surrender, and marched them up the country as prisoners. Another army, however, arrived under Generals Whitlocke, Crawford, and Sir S. Achmuty, in June 1807. Monte Video was taken by storm, with the loss of 600 men in killed and wounded on the part of the British. On the 5th July, an attack was made on Buenos Ayres; but the Spaniards had fortified their houses, broken up the streets, and made their defences so strong, that after a bloody and obstinate conflict in the town, the British general found it necessary to enter into terms with the enemy in order to effect his retreat; and thus an expedition, undertaken foolishly and without authority, cost Britain a vast sum of money, and some thousand lives, and brought disgrace on her arms, while it was the means of tempting thousands of her citizens into ruinous mercantile speculations. We return now to events more immediately belonging to the history of France.

The king of Naples, who had agreed by a treaty with France to observe a strict neutrality during the Austrian campaign, had inconsiderately allowed a body of Russian and English troops to land at Naples. Bonaparte immediately availed himself of this circumstance, by issuing a decree from Vienna, "declaring that the king of Naples had ceased to reign." A French army under Joseph Bonaparte immediately advanced into Calabria, and the Neapolitan government gave up the country without resistance. The fortress of Gaeta alone held out for a short time, and the peasantry of Calabria carried on a desultory warfare of little importance. A British force from Sicily under General Stewart landed in the gulf of St Eufemia, on the 1st July 1806, advanced to Maida, where it met the French army of General Regnier, nearly twice as numerous. A battle ensued, in which the French received a signal defeat, with the loss of 700 men killed, and two or three thousand wounded or prisoners. As the Neapolitans, however, were not excited to any new exertions by this event, the British army returned shortly after to Sicily, and the French occupied the whole country.

The emperor Napoleon now prepared to consolidate the great accession of power and territory he had obtained by new arrangements. Hanover, which the French had occupied, was given up to Prussia, who surrendered to France certain districts in return. Prussia followed up this measure, by excluding British vessels from her ports in the Baltic; and the British ministry retaliated by blockading the mouths of the Ems, Weser, and other rivers flowing through Prussia. Joseph Bonaparte was raised to the throne of Naples; the Venetian territories were added to the kingdom of Italy, the succession to which, in failure of heirs from Napoleon, was settled on Prince Eugene Beauharnois.

France. 1806. Holland, to bring her system into a correspondence with that of France, received a king in the person of Louis Bonaparte; and Murat received the principalities of Cleves and Berg. To crown this series of changes, the old constitution of the German empire was dissolved, and by an act of 12th July 1806, nearly all the smaller German powers were united into a body, denominated the Confederation of the Rhine, of which Napolean was created the head, with the title of *protector*. This confederation furnished the French emperor with a large auxiliary force of good troops, and was a formidable instrument in his hands in all his future plans of aggrandisement. It was finally dissolved in 1813; but the principles upon which it was founded have been embodied with little alteration in the new Germanic constitution. (See CONFEDERATION of the RHINE, in the SUPPLEMENT.)

556 Battle of Jena. The king of Prussia soon found that his co-operation in Bonaparte's plans would not secure him from spoliation or degradation, when it suited the views of the latter to humble him. The Prussian army and population too resented the indignities to which their king had submitted; and the latter, after making great sacrifices to maintain peace, found himself hurried into a war by circumstances which made no change in his relations with France. The bad faith of France, indeed afforded him just grounds of war; but of that bad faith he was well apprised before he entered into his engagements. With an ill-advised precipitancy, his preparations disclosed his hostile intentions before means had been taken to insure the support of Russia in sufficient time. Napoleon, who was never behind his opponents on such occasions, immediately assembled a formidable army, and advanced into Germany. Some actions of little importance brought the armies in presence of each other at Jena in Saxony, on the 13th October 1806. The battle commenced at day-light next morning between the armies, estimated at 130,000 men each. After a struggle of two hours the first advantage was gained by Marshal Soult on the French right; but this was by no means decisive. The Prussians, thrown partially into disorder, formed anew and fought bravely; but while the combat continued in suspense, Murat, who commanded the reserve, made a sudden and vigorous charge with the whole forces under his command, and overthrew the Prussians entirely. Never was a victory more complete. The Prussians, according to the French account, lost 20,000 killed, from 30,000 to 40,000 prisoners, besides 300 pieces of cannon, and immense magazines of military stores and provisions. The duke of Brunswick, and General Ruchel were among the killed. Such was the panic produced by this disaster, that most of the Prussian garrison towns, though well prepared for a siege, surrendered without attempting resistance. Erfurth with a garrison of 14,000 men, Magdeburg with 22,000, Stettin with 6000, Hameln, with 9000, Spandau and other fortresses, were reduced almost without bloodshed. Blucher alone distinguished himself by an obstinate but unsuccessful resistance. The French passed through Leipsic, and reached Berlin in a few days. A single victory gave them almost complete possession of the Prussian monarchy. The unfortunate king retired to Konigsberg, where he collected the wrecks of his army, scarcely amounting to 50,000 men, in order to await the arrival of his Russian allies. Bonaparte in the mean time organized a provisional government for Prussia; occupied Hamburgh, Lubeck, and other ports; and, irritated at the real or pretended abuse of the right of blockade by the British, he issued his celebrated Berlin decree, declaring the British islands in a state of blockade. The great extent of sea coast which he now commanded, enabled him to exclude the manufactures and merchandise of Great Britain from the continent much more effectually than he had ever done before; and though this decree was at first regarded as an impotent and ridiculous threat, the event shewed that it was the means of inflicting a serious wound on the commerce of Britain.

An ineffectual attempt was made by the king of Prussia to negociate; but the terms offered by the conqueror were so humiliating, that he preferred trying the chances of war with the aid of his Russian allies. About the end of November a division of the French army reached Warsaw, and re-established a bridge which the Russians had destroyed. The other corps arrived in succession, and crossed the Vistula. The Russian army was now collected in the part of Poland, immediately eastward of that river, and hostilities commenced. After some actions of less importance, a pretty severe engagement took place at Pultusk, in which the Russians were worsted, though they made a most determined resistance. The depth of winter now suspended hostilities for a short time. A part of the population of Silesia, excited by a proclamation of the king of Prussia's, had risen in arms; but they were defeated by a French force under Jerome Bonaparte, and after a short struggle, nearly all the fortresses in the province surrendered to the enemy. Early in February 1807, the contending armies, strengthened by reinforcements, recommenced hostilities. On the 7th and 8th was fought the battle of Eylau, one of the most obstinately contested engagements in modern times. The issue was in favour of the French, who remained masters of the field of battle; but it was by no means a decisive victory; and though the loss on each side was estimated at 30,000 in killed, wounded, and prisoners, no consequence of any importance resulted from it. During the pause which followed this bloody contest, the French pushed vigorously the siege of Dantzic; and that fortress was at last surrendered to them on the 21st May, after a brave defence by General Kalkreuth, and after repeated attempts by the allies to throw succours into it had failed.

The combined Russian and Prussian armies having collected their various corps, began a series of attacks on the French on the 5th of June, and continued them to the 12th, in all of which, however, they failed, and generally with great loss. On the 14th was fought the battle of Friedland. It commenced at five in the morning, and continned till seven at night; and though the Russians fought with determined courage, and succeeded at some points, the ignorance of their commanders, and the superior tactics and skill of the French, gave the latter a most decisive victory. The Russians lost altogether in the ten days, from the 5th to the 14th, forty thousand men, and twenty-seven generals. After the defeat they abandoned Koningsberg, crossed the Niemen, and continued their retreat eastward. Napoleon arrived at Tilsit on the 19th, and two days after this

this an armistice was agreed upon. On the 25th the emperors of Russia and France met on a raft constructed on the Niemen, and conferred together for two hours. Entertainments, reviews, and fetes followed, with all the external demonstrations of friendship and harmony. The peace of Tilsit, signed on the 9th July, deprived Prussia of all her territories on the left of the Elbe, and of all her recent acquisitions in Poland: Dantzic was created an independent town; East Friesland was added to Holland; the ceded Prussian territories in Germany were erected into the kingdom of Westphalia, the sovereignty of which was bestowed on Jerome Bonaparte; and the emperor Alexander agreed to recognize the titles of this new prince, of the kings of Holland and Naples, and of the new kings belonging to the Rhenish confederation. But what was most disgraceful to the Russian emperor, he obtained for himself the cession of a district of Polish Prussia from his distressed and humbled ally, to redress whose wrongs he pretended to take up arms. By a secret article Russia ceded the Ionian islands to France, and engaged to enforce the French continental system by excluding British vessels from her ports. In short, never had France acquired before in one campaign such extraordinary advantages.

Negociations for peace had been opened in February 1806 between the governments of France and Britain. The French ministers, however, shifted their ground again and again, eluded all direct and intelligible propositions, and seemed so anxious to separate the claims and interests of Britain from those of her ally Russia, that after some months spent in discussion, no progress was made, and all hopes of peace were abandoned. Mr Fox died during the discussions, but it is not probable that the prolongation of his life would have given a different termination to the negociations. Shortly after the treaty of Tilsit, Russia offered her mediation towards effecting a peace between England and France, but the offer was couched in terms so offensive to the British government, that it was promptly declined. In this state of things the ill-considered expedition to Copenhagen was undertaken, and furnished the Russian emperor with a most plausible pretext for those hostile measures to which he was already disposed. He was no sooner apprised of the seizure of the Danish fleet, than he dismissed the British ambassador, and published his resolution to put an end to all commercial intercourse with England, and to revive the principle of the armed neutrality. This was received and replied to as a declaration of war by the British government. The British property in Russia was forthwith confiscated, and the most vigorous measures were adopted to exclude our manufactures. The great extent of coast which Bonaparte now commanded, enabled him to make his edicts against our commerce operate with signal effect, and the pressure became very severe upon the cotton manufacturers and the West India planters. Parliament appointed a committee to investigate the subject, but, as might be expected, no means could be devised to afford any effectual relief. The orders in council issued by the British government, January and November 1807, were found to inflame the evil they were designed to cure.

On Bonaparte's return from the north after such splendid conquests, congratulations from public bodies and public functionaries flowed in upon him in uninterrupted succession: the powers of language were exhausted to find expressions, and history was ransacked to find comparisons, to set forth the glory and grandeur of his achievements. Now was the moment for his ambition to pause from schemes of conquest, and for giving his cares to those measures of internal improvement, which he declared should henceforth occupy his attention. But with such means of conquest in his hands, new enterprises were sure to tempt his ambition. Portugal had hitherto been suffered to enjoy a neutrality which had been denied to stronger states. Her trade with Britain, however, was now become an inexpiable crime; and as she refused to adopt the continental system, which would have involved her in war with her ancient ally Great Britain, her subjugation was resolved on. The government, fully apprised of the intentions of France, prepared a fleet, and on the approach of General Junot with a French army, the prince regent and court set sail for Brazil. As the means of the country were inadequate to a war with so powerful an enemy, no resistance was made; and so rapid was the approach of the enemy, that before the fleet had got out of the Tagus on the 29th November 1807, the French army was seen upon the heights.

557 Invasion of Spain.

Napoleon was now about to enter on another enterprise, more daring in its nature than any he had hitherto engaged in; and as the event shewed, more difficult and hazardous in its execution. The imbecile and disorganized government of Spain had hitherto been a passive instrument in his hands, by which he had held at his disposal the resources of the country, such as they were. But as he had already given kings to Holland and Belgium, he was tempted to think that Spain would consent with the same facility to see the drowsy and useless figures which misgoverned her thrust aside, and replaced by a branch of the imperial family. To pave the way for the meditated change, 16,000 Spanish troops, the flower of the army, were drawn away to Germany to act as auxiliaries to the French. And under the pretext of securing possession of Portugal, bodies of French troops, to the number of 70,000, were introduced into the north of Spain, and placed in the fortresses which commanded the roads into the country. When things were thus prepared, a plot was got up or discovered for killing the old king, in which his son Ferdinand was implicated; and afterwards the court was persuaded to embrace the absurd resolution of emigrating to Mexico. The discovery of this intention led to a popular tumult. The king intimidated, dismissed his minister Godoy, and resigned the crown in favour of his son Ferdinand. Murat was no sooner informed of these transactions than he advanced with the French army towards Madrid, and getting possession of the person of the deposed king, the latter declared that his resignation was compulsory. Ferdinand alarmed by the approach of the French, and the declaration of his father, was prevailed upon in an evil hour to submit his claims to Napoleon, and to repair to Bayonne to receive his award. When the two princes were thus within the power of Napoleon, a resignation of the crown was extorted from both, from the father on the 5th, and from the son on the 10th of May 1808, after which the royal prisoners were marched into the interior of France.

Murat

Murat in the mean time advanced to Madrid, and obtained possession of the city, but the spirit of the Spaniards was roused by the indignities offered to their king. The populace, unaided by the authorities, boldly attacked the French and drove them out with great loss on the 2d of May; but the latter returning in greater force, repossessed themselves of the town, and put to death above a hundred of the inhabitants in cold blood as conspirators. The supreme junta, entrusted by Ferdinand with the government, basely repressed the rising spirit of the people; and the holy inquisition did not scruple to lend its aid to a treacherous enemy, and to issue a circular enjoining submission to the French, accusing the people of faction and insubordination, and laying the guilt of the recent bloodshed upon them. When the news of the resignation arrived, it produced a universal burst of indignation. The spirit of resistance spread from province to province: Juntas were formed, among which that of Seville peculiarly distinguished itself by its activity and wisdom. Muskets and amunition were dispatched from Britain; all the unmarried men from 18 to 45 were summoned to arms, and a correspondence was established among the patriots in the different quarters of the country. The first measures of the Spaniards were eminently successful. Five French ships of the line lying in Cadiz were forced to surrender after three days cannonading. General Dupont, who had been dispatched too late to take possession of that port, attacked a superior force of Spaniards at Baylen, but was repulsed with such loss that he was not able to effect his retreat, and surrendered his army of 14,000 men prisoners. In the north Palafox defended Saragossa with astonishing courage and perseverance. The French were defeated with great loss in two attacks upon Valencia; and Joseph Bonaparte, after coming to Madrid with the title of king, backed by the nobles and the inquisition, and with a new constitution in his pocket, was compelled to measure back his steps on the 27th July. Thus, within less than three months Spain was almost cleared of its enemies by the valour and patriotism of its population.

These unexpected reverses had in no respect shaken Bonaparte's purpose. A new levy of 160,000 men was ordered in France; and large reinforcements were poured into Spain. Napoleon, after holding a meeting with Alexander at Erfurth, and receiving additional assurances of his support, joined his army in Spain, which had occupied the line of the Ebro for some months. By a series of persevering attacks, the three principal Spanish armies under Castanos, Blake, and Count Belvedere, were broken, and in a great measure dispersed; and on the 4th December Napoleon entered Madrid, after battering it for two days.

A British army of 30,000 men under Sir Arthur Wellesley landed in Portugal in July to assist the Portuguese, who had begun to rise in arms, in expelling their invaders. Junot advanced from Lisbon to meet them, and on the 21st of August was fought the battle of Vimiera, which ended in the defeat of the French. By the convention of Cintra which followed this battle, the British generals agreed to transport the French army to France; and much dissatisfaction was excited in England when it was found that so decisive a victory had not enabled the British commanders to dictate more humiliating terms. The generals were called home to be tried; and Sir John Moore was appointed to command the army. An additional force under Sir David Baird landed at Corunna, and the two armies advancing into Spain joined at Valladolid. Notwithstanding the flattering promises of support they received from the supreme junta, not a single regiment of Spaniards joined them; and the commanders having at length learned that Bonaparte was advancing upon them with a force of 70,000 men, they found it indispensable to retreat. As it was now the depth of winter, the retreat was attended with great loss and incredible hardships to the troops. The army reached Corunna on the 12th January 1809, and on the 15th was attacked by the French under Soult. They were repulsed at all points, but the death of General Sir John Moore, who fell early in the engagement, damped the joy of the victors. He was buried the next morning on the ramparts of Corunna. The loss of the British was about 700 in killed and wounded; that of the French about 2000. The British army embarked next day, and returned to England.

The occupation of so large a portion of the French force in Spain seemed to present a favourable opportunity to Austria for recovering some of her losses. She had been silently, but diligently, increasing and improving her military establishment, and re-organizing her finances. Bonaparte, who kept an eye on her proceedings, endeavoured to intimidate her; but failing in this object, he prepared for war. He called up the contingents of the Rhenish confederation, and with these, added to some large bodies of French troops, advanced into Bavaria. He attacked and defeated the Austrians at Ebensberg on the 20th, and at Eckmuhl on the 22d April, in which two battles the Austrians lost 40,000 men. These successes laid open the whole of Austria to him, and he reached Vienna on the 10th May, which was surrendered after a trifling resistance. The archduke Charles retired to Hungary, and took up a position near Presburg; and on the 21st and 22d was fought the battle of Aspern, one of the most bloody and obstinately contested engagements which has occurred in modern times. The Austrians were the assailants; and though they did not succeed in their object of driving the French across the Danube, it is yet clear that the latter suffered the greater loss, and had no victory to boast of. Not less than 30,000 men were killed or wounded on each side. The situation of Napoleon had never before been so critical. During the month of June he was assiduously employed in collecting troops. On the 6th July, having completed his preparations, he attacked the Austrians at Wagram, and by superiority of skill, more than numbers, gained a decisive victory. The loss of the Austrians, according to the French accounts, amounted to 40,000 killed and wounded, and 20,000 prisoners. Another defeat at Znaim entirely ruined their hopes; and they now sought peace on the conqueror's terms. The treaty of Presburg, which was not definitely arranged till October, subjected Austria to less considerable sacrifices than had been expected. To France she gave up Fiume and Trieste, with the whole northern shores of the Adriatic; to Bavaria certain districts between the Alps and the Danube, with the Tyrol; to Saxony she ceded the western part of Galicia, and to Russia the district of Tarnopol on the east of that province. In the Tyrol, and in the north-west of Germany, a desultory war was carried on against the French for a short time; but the resistance in both cases proved unavailing.

Bonaparte, in the course of this campaign, had annexed the papal territories to the French empire, by a decree dated from Vienna. Parma, Placentia, and Tuscany, had been added some time before.

Soon after the breaking out of the war between France and Austria, the British ministers collected a large force, naval and military, for an expedition, the object of which was kept a profound secret. It sailed from the Downs on the 29th July, and on the 1st August, Flushing, in the island of Walcheren, was invested. The place held out till the 14th, when the garrison of 4000 men surrendered prisoners of war. Antwerp was the main object of the expedition; but the British commander, the earl of Chatham, had neglected to seize some forts which would have facilitated his approach to the place; the French had employed the time lost in the siege of Flushing in strengthening the defences; and the capture of that great naval depot was now judged to be impracticable. The expedition then returned to England, to the great disappointment of the nation, who anticipated some more important result than the occupation of a useless sandy island, from an expedition consisting of 40,000 chosen troops, and 35 sail of the line. The public mortification was increased in the sequel. The ministers resolved to keep possession of Walcheren, apparently for no other reason than that they were ashamed to renounce what had cost them so dear. A pestilential fever, the annual and regular scourge of the place, which broke out among the troops, destroyed or disabled nearly all who remained in it, and ultimately rendered it indispensable to abandon the island.

In the month of April, this year, a most gallant and daring attack was made by Lord Cochrane on the French fleet in Basque roads, by which six ships of the line were driven on shore and rendered useless, and three others, besides frigates, were burnt.

After the expulsion of the British from the peninsula, the Spanish armies were attacked by the French, and defeated in various engagements; but the patriotism of the people soon filled up the ranks again, and kept a respectable force on foot. Saragossa was besieged a second time, and defended with incredible valour and perseverance, till it was reduced to a mass of ruins, and 30,000 of its inhabitants had perished by the sword and disease. Another British army, which had been recently landed in Portugal under Sir Arthur Wellesley, marched into Spain, and joined the Spanish force under General Cuesta. The two armies advanced towards Madrid, and at Talavera were attacked by the French under Marshal Victor. The battle continued two days, and terminated in the repulse of the French, who retired in good order. The loss of the latter was estimated at 10,000 men; that of the British and Spaniards at 7000. The rapid advance, however, of Soult and Ney from the south compelled the British general to measure back his steps to Badajoz, and no advantage was reaped from the victory. From the middle of summer to the end of the year a number of actions were fought between the French and Spaniards, in which the former were generally successful, though they sometimes experienced reverses. The battles of Ocana and Alba were peculiarly disastrous to the Spaniards, and broke their confidence so completely, that for a considerable time after they offered little resistance to their enemy, who possessed himself of Seville, and all the most considerable places in the south except Cadiz.

Massena arrived in Spain in the spring of 1810 with large reinforcements, and assumed the command of the French army destined to act against Portugal. After taking Ciudad Rodrigo and Almeida, he advanced to Busaco, and attacked the British in their strong position there, but was defeated with great loss. The pass by the northern edge of the Sierra, however, being left open by accident, he proceeded through it to Coimbra, and thence to Torres Vedras, where finding the British army posted in an impregnable position, he retired a short distance, and took up his quarters at Santarem. Here he remained from the 15th November to the 5th of March, when he returned to Spain, continually harassed in his retreat by the British.

In the course of this year, the islands of Guadaloupe in the West Indies, and of Mauritius and Bourbon in the Indian ocean, were taken from the French by the British with little loss.

The peace of Presburg had put it in Bonaparte's power to accomplish an object, on which it is probable his thoughts had long been bent. Possessing a power surpassing that of any sovereign in Europe, he was anxious to ally himself by marriage with some of those royal families, who could add the lustre of ancient renown to the titles which the sword had given him. His marriage with the archduchess Maria Louisa took place in March 1810. It was followed by splendid fetes, and multitudes of addresses, couched in the most sickening style of hyperbolical flattery. As if this new alliance had made him more regardless of public opinion, he, about the same time, issued several decrees of a most arbitrary nature, of which one authorized the detention of all such persons as the government might suspect, without bringing them to trial; another ordered the names of all servants, male or female, employed in families, to be registered at the police, obviously for the purpose of perfecting the system of espionage previously established; and several others subjected the press to a rigid censorship, and limited the number of printers and booksellers. His brother Louis, king of Holland, being found too humane for the rigorous system he had adopted, was set aside; and that unhappy country, as well as Bremen, Hamburg, and Lubeck, with the intermediate sea coast, were added to the French empire. He was now in fact at the acme of his power. Within the empire, if he did not enjoy the love of his subjects, he had dazzled their judgments by his exploits, and commanded their admiration. The conscription furnished him with an inexhaustible supply of soldiers. His revenues were equal to his expenditure; and a crowd of tributary kings and princes, who owed their dignities to him, enabled him to command the resources of all the adjacent countries. Of the only two princes on the continent capable of disturbing his security, the one was his firm supporter, and in some measure the participator in his crimes; the other was closely connected with him by family ties. The countries directly under

France. 1811. under his authority were now a half larger than old France, and contained *forty-four millions* of inhabitants; but including the dominions of his tributary princes, namely, Naples, Lombardy, and the confederation of the Rhine, he ruled over an extent of territory embracing 490,000 square English miles, and containing *seventy millions* of inhabitants. This is exclusive of Spain and Prussia. So great an extent of dominion had never been held by one man in modern times; and yet, with all its appearances of stability and overwhelming power, the causes were already in operation which worked its overthrow.

During 1811 the war was carried on with undiminished activity on both sides in the Spanish peninsula. A division of the British army having laid siege to Badajoz, Soult advanced to relieve it, and attacked Marshal Beresford at Albuera. The battle was remarkably obstinate and bloody, but the French general did not drive the British from their post, though he did not sustain a defeat. The siege, however, was raised, though only for a short time. Another battle, equally obstinate and bloody, was fought between some divisions of the British and French armies at Fuentes d'Honor, which ended in the repulse of the French. Another glorious but unprofitable victory was gained by General Graham at Barrosa, in March. On this occasion, the jealousy or cowardice of the Spanish general, La Pena, alone prevented the total destruction of the French army. Badajoz and Ciudad Rodrigo were taken by the British, the latter by a very bold and gallant attack. To balance these successes, however, the French took Tarragona, Murviedro, Figueras, and Valencia; but none of them without considerable resistance. A series of defeats had at length taught the Spaniards the imprudence of meeting the French armies in the field. They now confined themselves much more to desultory hostilities, the surprising of posts, the harassing of foraging parties, the intercepting of supplies and dispatches. The small corps who carried on this species of warfare had the name of *guerillas;* and a new race of leaders sprung up among them, who attained great distinction by their courage and enterprise. Of these Sanchez, Porlier, Mina, and Martin were the most celebrated.

After the reduction of Badajoz and Ciudad Rodrigo, the British army moved northward; and on the 22d July 1812, was fought the celebrated battle of Salamanca, in which the French, under Marshal Marmont, were defeated with the loss of about 13,000 men, of whom 7000 were made prisoners. This splendid victory was immediately followed by the evacuation of Madrid by Joseph Bonaparte; and shortly after Soult raised the siege of Cadiz, and retired northward. Lord Wellington pressed on the broken French army for some time, but failed in his attempt to take Burgos from the want of heavy artillery. The French, however, having soon concentrated their different armies, were again in a condition to advance. They compelled the British commander to raise the siege of Burgos, and about the end of October again occupied Madrid. The retreat of the British was attended with much loss, chiefly in consequence of the state of the weather and the roads.

553 War with Russia. At the peace of Tilsit, the emperor Alexander had agreed to adopt the continental system, by excluding British manufactures and produce from his ports. He persevered in this course till the complaints of his nobles induced him to relax the prohibition, and to permit British goods to be imported in limited quantities under licence. This concession, which had been wrung from him by necessity, was highly resented by Napoleon, who seized the duchy of Oldenburg, belonging to the emperor's brother-in-law, and presented menacing remonstrances to the Russian monarch. Alexander, though really anxious for peace, could not revoke the concession, and nothing less would satisfy his ally. Both sides then prepared for war. Bonaparte collected the troops of Westphalia, of the Rhenish confederation, and of Italy; and with these, joined to a large body of French stationed in Prussia, he took the field. This army was computed to amount to 360,000 men; and certainly surpassed in numbers, discipline, and in the skill of the commanders, any that Europe had ever witnessed. The Russians had been equally diligent in preparing for hostilities; but as a great part of their troops were new levies, it was part of their plan not to hazard a general action at first, but to train their men to military habits by the defence of posts, and by partial engagements. Napoleon left Paris in May 1812, and reached the banks of the Niemen 22d June. A continued series of small engagements followed, in which the French, though they generally saw their enemies retreat, had little advantage to boast of. The Russians, though inferior to their enemies in discipline and equipments, constantly displayed a desperate courage. In every contest, small or great, the victors purchased their success extremely dear, and few prisoners were taken on either side. The first general battle was fought under the walls of Smolensko on the 17th August, and terminated in the defeat of the Russians, and capture of the town, which was on fire in many places when the victors entered it. Had Napoleon now stopped in his career, and employed the winter in organizing Poland, of which he had complete possession, he might, in the ensuing spring, have resumed his operations under the most favourable auspices, and in all probability have dictated a peace under the walls of Petersburg. But a fatality hurried him on, against the advice, it is said, of his ablest generals. He followed his enemy boldly into the centre of Russia, undismayed by the approach of winter. The sanguinary battle of Borodino, in which the Russians were compelled to retire, rather than defeated, opened his way to Moscow, which he entered on the 15th September. But what was his surprise to find that the Russians had set fire to their ancient capital. The flames burst out in a hundred places after the French entered the town; and four-fifths of the houses were destroyed. The conqueror now saw the dangers of his situation; and after waiting some time in the hope of receiving a submissive application for peace from the Russians, he at length condescended to offer them terms. His proposals were indignantly rejected. Mortified by this circumstance, he reluctantly left Moscow on the 16th October. We forbear to give the details of the disastrous retreat which ensued. Suffice it to say, that the vengeance of an exasperated enemy tracked his footsteps, and left him not a moment's respite. The country in his rear had been occupied, and his exhausted and dispirited army had to dispute every height and every pass. Those whom the sword spared, the

the rigour of the climate destroyed; and of the fine army of 360,000 men, with which he entered Russia, scarcely 50,000 returned to Poland. At the end of the year the wrecks of the army reached Marienwarder in Prussia.

Napoleon had left the army in Poland, and travelling rapidly with a small escort, he arrived in Paris before the end of the year. In his address to the legislative body, he admitted that a heavy calamity had befallen the army, to repair which, great sacrifices would be necessary. A pompous exposition was then made of the resources of the country, and of the improvement which had taken place in it since the revolution. On the 11th January 1813, a *senatus consultum* was issued, decreeing a levy of 350,000 men; and so perfect was the system of the conscription, that in a few weeks this enormous levy was raised, and after a short drilling, the men were marched off to Germany, in separate bodies. Napoleon before leaving Paris, effected a reconciliation with Pope Pius VII. by restoring his temporal possessions; and he at the same time nominated the empress regent during his absence. He joined the army on the Elbe about the middle of April.

The emperor Alexander was determined to follow up his successes with the utmost vigour. New and extensive levies were made throughout his empire, and he endeavoured at the same time, to engage the kings of Sweden and Prussia in the war. As Denmark continued to adhere to the French cause, the bait held out to the Swedish crown prince, was the conquest of Norway, in which Alexander engaged to assist him. The king of Prussia had so often suffered from the overwhelming power of France, that his fears held him long in suspense, and he was at last only driven into an alliance with Alexander, by the impatience of his subjects to deliver themselves from the French yoke. At length both he and the Swedish crown prince engaged cordially in the cause. Austria for the present professed neutrality; but Napoleon was aware that no reliance could be placed on her, and that any fresh disaster might tempt her to become his enemy, notwithstanding the family alliance. She had recruited her army, and put herself in a condition to derive advantage from any circumstances which might occur.

Campaign of 1813.

The campaign was opened in April. The French army assembled on the Elbe amounted to 170,000 men, but with a very small proportion of veteran troops. The Russian, Prussian, and Swedish forces were estimated at 200,000. After some fighting, of less consequence, the two armies met on the field of Lutzen, on the 2d of May. A line of five or six villages occupied by the French were attacked, taken and retaken several times, till night put an end to the combat. The allies retired next day, but were not molested in their retreat by the French, though the latter claimed the victory. In the French official dispatch to the empress, it was affirmed that this action, like a clap of thunder, had dissipated the chimerical hopes of those who calculated on the destruction of the French empire. The allies, however, were not disheartened. They received considerable reinforcements soon after, and again resolved to abide the combat. The battle of Bautzen fought the 20th and 21st May, was as severe and bloody as that of Lutzen, but the advantage which the French obtained was rather more decisive. Austria, who had, as already mentioned, greatly increased her military force, now interposed her mediation. She felt herself in a condition which enabled her to interfere with effect, and she had an obvious interest in preventing Napoleon from again attaining that baleful ascendency under which she had suffered so much. Napoleon was sensible that notwithstanding the advantages he had gained in Germany, the state of his affairs in Spain rendered his situation precarious. The mediation of Austria was accepted by both parties, and an armistice concluded on the 4th June. A congress was formed at Prague; but the negociations, which were continued till the 10th August, served only to show how irreconcilable the objects of the contending parties were. In the course of the discussions, Austria went more and more into the views of the allies. She proposed that the duchy of Warsaw should be suppressed, the Prussian fortresses occupied by the French given up, the Illyrian provinces restored to her, and the confederation of the Rhine dissolved. These terms were rejected by Bonaparte, who endeavoured, but in vain, to bribe Austria to co-operate with him, by offering her a large section of the Prussian monarchy. At length all prospect of pacification disappeared. Austria joined herself to the allies, and both parties appealed once more to the sword.

While the armistice lasted, Prussia had made great exertions to recruit her armies. The king made a strong appeal to the people, promised them a representative constitution, and called upon them to deliver their country from a foreign and hateful yoke. The call was obeyed with unprecedented zeal. Vast numbers presented themselves spontaneously to be enrolled; a large militia force was organized, as a support to the regular army; carts and horses were voluntarily supplied by the peasantry; and the women furnished clothes and flannels for the use of the soldiers. In short, the whole of Prussia resembled a camp.

The first considerable action after the campaign recommenced, was fought at Jauer in Silesia, where the French, under Marshal Macdonald, were defeated with great loss by Blucher. This was followed by the battle of Dresden, fought on the 26th, 27th, and 28th August, in which the allies were repulsed with the loss of 20,000 or 30,000 men, and the celebrated General Moreau was mortally wounded. The entire destruction of Vandamme's corps shortly after in Bohemia, was, however, a compensation for this disaster. The Austrians in the mean time, had formed a junction with the allies, who were farther strengthened by the arrival of a corps of 40,000 Russians under General Beningsen. The Westphalians, released from the presence of the French, by the irruption of a body of Russians, declared against the French; and at the same time the Bavarians made a treaty with Austria, and joined the allies. Napolean now found his situation more critical than ever. He was greatly outnumbered by his enemies, his allies were daily deserting his standard, his troops were inexperienced and dispirited, and he was at a distance from France in the midst of a hostile population. From that fatal confidence which he had displayed in his Russian campaign, he did not attempt a retreat while such a measure was practicable. The allies pushed bodies of troops forward on both

France. 1813. both flanks, till his communication with the Rhine was intercepted, and his position almost surrounded. Napoleon now prepared for the combat, which he saw was unavoidable, by concentrating his troops, and strengthening the weak points of his position with field-works. The decisive battle of Leipsic, the greatest and most eventful in modern times, was fought on the 16th, 17th, and 18th October. On the 16th, the advantage at the close of the day was rather on the side of the French: the 17th was spent chiefly in preparations for renewing the engagement. Even on the 18th, the success of the allies was not so complete, that it would have been ruinous to Napoleon's army, had the bridge between Leipsic and Lindenau not been destroyed prematurely, and exposed the divisions of Macdonald and Poniatowsky to destruction. The loss of the French was estimated at 60,000 men, in killed, wounded, and prisoners, and 500 pieces of cannon. Their route to the Rhine was strewed with baggage, artillery, and every species of military wreck. At Hanau they encountered the Bavarian general Wrede, with 35,000 men, but he was not able to stop their march. The remnant of the army crossed the Rhine at Mentz, on the 7th November.

Bonaparte after his first reverses in Russia had weakened his armies in Spain, by drawing troops from that country to Germany. The British and Spanish generals now prepared to avail themselves of this advantage. The French withdrew from Madrid in the end of May, and appeared at first disposed to defend the line of the Ebro. But this intention was soon abandoned, and they continued to retire northward. At Vittoria the British general attacked them on the 20th June, and gained a brilliant victory. A second victory in the heart of the Pyrenees enabled Lord Wellington to lay siege to Pampeluna and St Sebastian, both of which were reduced. The war was now carried into France, and after five days fighting, the strong lines which the French had formed in the neighbourhood of Bayonne were forced, and the British and Spanish armies advanced to the Adour.

The supports of Napoleon's power now crumbled down on all sides. The Confederation of the Rhine was entirely dissolved immediately after the battle of Leipsic, and the whole of the German auxiliaries were from that moment lost to the French cause. In his efforts to collect an army, Napoleon had withdrawn almost all the French troops from Holland. The Dutch, who had suffered severely from his anticommercial principles, gladly seized the opportunity to shake off the yoke. A conspiracy was formed at the Hague and in Amsterdam; the Dutch military joined the people; and Holland recovered her independence almost without a struggle. On the 30th November the prince of Orange arrived from England, and was greeted with the liveliest acclamations of the people.

Preparatory to entering France, the allied sovereigns issued a proclamation from Frankfort (1st December), in which they declared to the French nation, that they had no plans of conquest in view; that they wished France to be great, happy, and free; and that it was solely against the ambition of Napoleon, who held all the neighbouring states in slavery, that they made war. The French emperor called for a new levy of 300,000 men, and by his own authority increased the existing taxes. The legislative body was convoked, and for the first time ventured to speak another language than that of adulation. A deputation of its members drew up a report (28th December), in which they stated the necessity of uniting the nation to the throne, by an open renunciation of projects of aggrandisement, and by maintaining the entire and constant execution of the laws which guarantee liberty, and the free exercise of political privileges. These they considered as the only means of giving energy to the French in their own defence. Napoleon resented the freedom of this statement with the insolence which unbridled power had taught him. He taxed the members of the committee with faction and treason; and without regard to their remonstrances, took measures for recruiting his armies, and raising the nation *en masse*. But the people, worn out with his endless demands, answered his call to arms with much less zeal than was evinced by the Prussians in a similar case.

The allies passed the Rhine on the 1st January 1814, and spread themselves over the Netherlands and Alsace, without experiencing much resistance. They wisely pressed on, without losing time in besieging fortresses. A last and fruitless effort was made to negociate, but without suspending hostilities. Commissioners met at Chatillon on the Seine. The basis proposed by the allies was, that France should be reduced within the limits she occupied in 1792; and that Antwerp, and certain other strong places, should be put immediately into their hands, till the treaty was completed. The French ministers shifted their grounds as the fortunes of their master fluctuated, during the course of hostilities, till the negociations were closed on the 18th March. It would be tedious to recount the various movements and battles of the different armies, which were now pressing towards Paris as a common centre, and against which Napoleon made head with a very inferior force. It is admitted that he never displayed greater ability than in this short campaign; and that the French troops, though consisting in a great measure of raw levies, never fought with greater intrepidity. No exertions, however, could now avail against the overwhelming force of the allies under Prince Schwartzenburg. Laon, Rheims, Troyes, Montmiral, Arcis, places within seventy or eighty miles of Paris, were the scenes of sanguinary contests, in which the French often succeeded; but still the loss generally operated more severely upon their small force, than upon the larger masses of the allies. It was on the 22d March that Napoleon made a movement, which suddenly changed the state of the war. Placed between two armies of a hundred thousand men each, with a force not exceeding sixty thousand, he attempted by a desperate effort at Arcis, to disable or defeat one of his antagonists; but failing in his design, and despairing of forcing the position of the Austro-Russian army, he ventured on the daring project of retiring to Vitry, where he was interposed between the two hostile armies, but where he was in no condition to prevent their approach to the capital, if they chose to follow that course. He calculated that Prince Schwartzenburg would not advance to Paris, while he hung on his rear; but that on the contrary, he would be followed by the Austrian general, who would thus be drawn away from the capital, without the expence of a battle. The result, however, disappointed ance. 814. pointed his calculations. Blucher and Schwartzenburg pushed rapidly forward, leaving a corps to observe Napoleon's motions, and on the 28th March reached the neighbourhood of Paris. The French emperor saw his error when too late, and in the first moment of despair, addressed a letter to his father-in-law at Dijon, entreating him to interpose to secure the throne to his daughter's child. But his application was fruitless. On the 29th several of the villages on the north of the capital were taken after a brave defence; and on the 30th the allies drove the French within the barriers, when Marshal Marmont seeing farther resistance to be hopeless, proposed a capitulation, which was signed at two in the morning on the 31st March. The allied sovereigns with their troops entered Paris the same day. The inhabitants were assured by proclamations, that they came not as conquerors, but as friends and deliverers; that private property and rights should be religiously respected, and no insult offered to the national feelings. In such circumstances, it was not wonderful that a people so susceptible of sudden emotions as the French, relieved by this liberal conduct from the most appalling apprehensions, should welcome the allied princes with unbounded acclamations. As they passed into the city through the suburb of St Martin, shouts of *long live Alexander, long live Frederic William, long live our Deliverers*, were heard on all sides. The Parisians were divided into three parties. The most considerable party in point of numbers was chiefly anxious about the establishment of a free constitution; another party was attached to the existing order of things, and wished to secure the crown to Bonaparte's son; the third and smallest party consisted of Royalists, and desired merely the restoration of the Bourbons. The allies naturally wished to favour the last party; but as Alexander professed his readiness to allow the French to form a constitution for themselves, and to make what conditions they pleased with their prince, the liberal party, with a few exceptions, declared for the Bourbons. The senate assembled, with Talleyrand at its head, decreed on the 2d April, that Napoleon by his various acts of ambition and tyranny had forfeited the throne. A plan of a constitution was immediately afterwards drawn up, and unanimously adopted by that body, under which it was carried, that the crown should be offered to Louis, brother of the late king. By this instrument, the supreme authority was vested in the king, the senate, and legislative body; the king was to possess an absolute *veto;* the senate was to consist of not less than 150, nor more than 200 members, whose dignities were hereditary; the legislative body was to be elected immediately by the electoral bodies, for a period of five years. The existing nobility were to preserve their titles, and the old nobles to resume theirs. The freedom of the press was guaranteed. While these great changes were taking place in Paris, Napoleon remained at Fontainebleau, from which he sent Marshals Ney and Macdonald to negociate with the allies, and to endeavour to secure the succession to his son. The restoration of the Bourbons, however, had already been determined on; and the result of the negociation was, that Napoleon was allowed to retire to the isle of Elba, with a pension of two millions of francs per annum (80,000l.); one million more were assigned to the ex-empress Josephine; two millions and a half to the other branches of the imperial family; and the sovereignty of Parma, Placentia, and Guastalla, was given to the empress Maria Louisa, and to her son in succession. Napoleon was permitted also to take with him to Elba, 400 volunteers as a guard,

560 A[lli]es enter P[ari]s.

56[1] Napo[le]on retire[s] to Elba.

France. 1814.

While the allies were thus bringing the war to a happy termination in the north of France, Lord Wellington was advancing with uninterrupted success in the south. His lordship passed the Adour, as soon as the cessation of the rains rendered the roads passable, and on the 27th February attacked Soult in his strong position at Orthes. The French army, though much inferior in numbers to the allies, made a most determined resistance, but was at length driven back with the loss of seven thousand men. This victory opened the city of Bourdeaux to the conquerors, where the white flag was immediately displayed, amidst shouts of *long live the Bourbons.* Soult retired slowly towards Thoulouse, under the walls of which he took up a very strong position. He was here again attacked by the allied British and Spanish armies on the 10th April. The French commander availed himself of the advantages of his situation with consummate skill, and baffled his antagonists for many hours; but he was at last overpowered, and compelled to retire, leaving the city to be occupied by the victors. The loss of the British and Spaniards in this battle which terminated the war, amounted to five thousand men: that of the French has not been mentioned, but must of course have been greater. Next day intelligence of the capitulation of Paris arrived, and immediately led to the suspension of hostilities.

562 Restoration of the Bourbons.

Louis left his residence in England, and arrived at Paris on the 3d May, where he was welcomed with the tumultuous acclamations of the populace. The negociations now proceeded rapidly, and the peace of Paris was signed on the 30th May. The limits of France were re-established as they existed on the 1st January 1792, except that some small additions were made for the sake of rounding the frontier. She received back all her colonies except Tobago, St Lucia, the Mauritius and its dependencies, and the part she possessed of St Domingo. The allies discharged her of all pecuniary claims, or claims for compensation, except those of private individuals; and she was allowed to retain the works of art collected in the Louvre from the spoils of Italy and Germany. Considering how wantonly the victors had been provoked, and how much they had suffered from the restless aggressions of Napoleon's government, it must be admitted that the terms they dictated to France were extremely liberal, and that they made a very temperate use of their power.

Louis thus found himself reinstated on the throne of his ancestors without any effort of his own. Though his situation presented considerable difficulties, they were such as prudence and liberal conduct on his part would have surmounted. As his policy was necessarily pacific, he could not hope to detach the affections of the army from the celebrated commander who had been so long their idol. But in these circumstances, it was so much the more incumbent on him to attach the nation firmly to his cause; to unite their interest with his own, by establishing liberal institutions, and by showing the people that their only security for the blessings of

France. 1814. of unshackled industry, the upright administration of justice, and a really free government, depended the stability of his throne. The great changes which had taken place in the state of property in France had created an interest adverse to his family; and the enjoyment of liberty was the only bribe by which Louis could hope to reconcile this hostile interest to his authority. Unfortunately it was found that the schooling of adversity had produced no beneficial effect on the Bourbon dynasty. The very first acts of Louis betrayed arbitrary principles. He rejected the constitution framed by the senate, and ratified by a large portion of the legislative body, and promulgated another by his own authority, less liberal in its character, and rendered the more offensive because it asserted the supreme and uncontrouled power of the crown, though it admitted the propriety of regulating its exercise according to circumstances. He assumed the title of Louis XVIII. and dated the year of his accession as the 19th of his reign, thus declaring all the acts of the preceding period rebellious and illegal. His new ministers, chiefly emigrants, evinced a restless and violent spirit. Though subjected to the forms of a representative government, they did not hesitate to avow the principles of absolute monarchy in their speeches; and some of them were so imprudent, as to give no very obscure hints that a time might soon come when the property of emigrants would be reclaimed. The freedom of the press, so pompously announced by the charter, was violated by the establishment of a rigorous censorship; and to show that this was not meant to be a temporary measure, it was professedly founded on the rash and impetuous disposition of the French people. The situation of the finances, it was declared, would not admit of the abolition of the *droits reunis*, which had been promised. The conscription, though nominally laid aside, was re-established before any relief was experienced from its abolition. In short, the French soon found or conceived, that the return of the Bourbons brought no alleviation of their grievances. The peace which attended their restoration was considered as stamped with national ignominy; they were viewed as having all the arbitrary principles of Napoleon, without any pretensions to his talents or his renown. They were dreaded as the friends and patrons of feudal rights, and as the enemies of those revolutionary interests which comprehended so great a portion of the population. The public discontents arising out of this state of things, would not have shaken their power had they been secure of the attachment of the army; but possessing neither the confidence of the soldiers nor the people, the indiscreet and violent measures they adopted continually increased the perils that surrounded them. All that has transpired since 1815, has tended to show more and more clearly that the subversion of their power was not the consequence of any conspiracy, but was simply the effect of the attachment of the military to their old commander, and of the indifference or hostility of the great bulk of the population.

The constitution or charter granted by Louis, vested the elective franchise in persons of thirty years of age, and paying 300 francs (12l.) direct taxes. This law, which is still in force, restricts the right of voting to about 110,000 persons in the whole of France. The individual eligible as a representative must be forty years of age, and belong to the class which pays 1000 francs (40l.) direct taxes. The chamber of peers consists of persons holding their dignities either for life or hereditarily. This court, named by the king, and whose deliberations are secret, takes cognizance of crimes of high treason, and all attempts against the state. In both chambers the king has the initiation of all laws. It is unnecessary to dwell upon the principles of such a constitution. A body better contrived than the chamber of peers for destroying individuals obnoxious to the government could not easily be conceived. The intention of confining the choice of deputies to persons above forty, is partly no doubt to limit the number who are eligible, but still more to fill the chamber with individuals born before the revolution, and therefore more probably attached to the old *regime*. The object in making the qualification of electors so high, is obviously to confine the franchise to so small a number of persons, that the government by its money and patronage may be able to corrupt them, and thus in effect name the deputies itself. As it turned out, however, that the French ministers were not so dexterous in the trade of corruption as some of their neighbours, and that the national voice still made itself heard through this very imperfect instrument, a great change was made in its composition in 1820. The power of returning nearly two-fifths of the members is now vested in about 20,000 persons; and by gaining one half of these, and a small proportion of the rest, perhaps in all about 25,000 or 30,000 individuals, the government can secure a decided majority of its own creatures in the chamber. With a revenue of thirty millions sterling a-year, and such a multitude of places, titles, and distinctions to bestow, it can never be difficult for the ministry to accomplish this object. It is a mockery to give the name of a chamber of representatives to such a body which represents not the sense of the people, but the will of the court. It is a convenient instrument of taxation and coercion, a mask which conceals the harsh features of despotism without restraining its malignant spirit. It is necessarily doomed by the vices of its constitution to be the enemy —not the friend of popular rights, the champion of prerogative, the protector and promoter of the corruption and profusion by which it is nourished. We now return from this digression to our narrative.

France. 1814. Napoleon landed in Elba on the 4th May. For some time his active mind seemed to be entirely occupied with the embellishment of his capital and with various rural pursuits. He conversed freely with the British and Austrian commissioners, and with strangers of all nations, about the scenes and events of his past life, and seemed perfectly reconciled to his situation. But after some months residence he suddenly assumed more retired habits. He abandoned his usual pursuits, rarely received visitors, and when seen appeared absorbed in thought. He was in fact now maturing a project for recovering the French throne. He kept up a correspondence with various individuals in France who were disgusted with the conduct of the Bourbons; and it was most probably the numerous and increasing symptoms of discontent in that country which induced him to embark in the daring enterprise. He secretly augmented his military force, and collected a number

number of small craft; and the execution of his design is said to have been hastened by the intelligence he received that the allied princes at Vienna had it in contemplation to transport him to St Helena. At length, on the 26th February 1815, he left Porto Ferrajo with 900 men, on board of seven vessels, of which one was armed. With this handful of men he was now about to invade a powerful kingdom, defended by an army of 200,000 soldiers. A landing was effected on the 1st March, near Antibes. For five days he received no support, and his situation appeared extremely critical; but a force of 6000 men sent from Grenoble to arrest his progress having joined him, and the garrison of that city having immediately after declared in his favour, his difficulties were in a moment at an end. From this period every regiment sent against him served to swell his army. The people, even those who had insulted him during his journey to Elba, moved by novelty, or disappointed in the conduct of the Bourbons, strewed his path with flowers, and received him as a deliverer with joyful acclamations. In short, his journey to Paris was a continued triumphal procession. He reached that capital on the 20th March, in the evening, and, without shedding one drop of blood, reascended the throne from which he had been driven eleven months before. Louis had left Paris at one o'clock the same morning, accompanied by a few emigrants, without the body of the people testifying the least concern for his misfortunes, or the least regret at his departure. He retired to Ghent in the Netherlands.

Though the whole of France submitted almost instantaneously to Napoleon, he was well aware that vast exertions would be required to establish his power. The great princes assembled at the congress of Vienna, no sooner learned that he had landed in France, than they issued a proclamation, placing him "without the pale of civil and social relations," and declaring their determination to maintain the dispositions of the treaty of Paris at all hazards. Sensible of the difficulties of his situation, he now endeavoured to unite the national feeling to his cause by a liberal system of government. A new *constitutional act* was promulgated, establishing a hereditary chamber of peers, and settling a plan of representation, which, though not entirely unobjectionable, was infinitely preferable to any that had been in operation since the dissolution of the republican government. The two chambers, when they afterwards met, evinced a spirit of independence to which France had been a stranger for 15 years. The censorship was abolished by an imperial decree, and every thing was done to give a popular character to the acts of the government. Deputations called from the electoral colleges, met at Paris, and an assembly, to which the ancient name of a *Champ de Mai* was given, swore to maintain the constitution. Bonaparte had been all the time sedulously employed in strengthening his army. It was desirable to act before his enemies could concentrate their vast resources; and as soon therefore as his preparations were tolerably advanced, he hastened to the Netherlands. Both the Prussians and British were taken by surprise. The former were attacked and repulsed near Charleroi with considerable loss on the 15th. On the 16th were fought the battles of Quatre Bras and Ligny, in which the Prussians again suffered severely; but the small body of British engaged maintained their ground by astonishing efforts of heroism. Napoleon had now accomplished one object; he had separated the main body of the Prussians from their allies; and the 17th was spent in preparations for a conflict with the British on the following day. The duke of Wellington had taken up a station in a position chosen by himself in the neighbourhood of Waterloo. Here he awaited the attack of the French, which commenced at mid-day on the 18th. It is impossible to do justice within our present limits to this memorable battle. Both generals exerted themselves to the utmost; and never did two armies second the skill of their commanders by a more devoted courage. The immoveable firmness of the British troops, defied the tactics, the enthusiasm, and the desperation of their enemies; and on the arrival of the Prussians at sunset, the French, worn out by incessant but fruitless efforts, were at length overthrown with unexampled carnage, and the entire loss of their artillery and baggage. The victory was so decisive, that the flight was a complete route, the beaten army seemed totally dissolved, and scarcely a semblance of resistance was offered. The total loss of the French in this battle was never accurately ascertained, but has been estimated at 40,000 men in killed, wounded, and prisoners, out of an army of 80,000. Napoleon arrived at Paris on the 20th, and finding that he was now considered as the only obstacle to peace, he resigned the imperial crown in favour of his son. The two chambers conducted themselves with great firmness and wisdom in this trying conjuncture. They formed a provisional government, sent commissioners to treat with the allies for peace, made preparations for defending Paris, and found themselves so warmly seconded by the national spirit of the people and the army, that probably nothing but the extreme difficulties of their situation, from the sudden approach of an overwhelming force, prevented a general rising of the nation to defend its independence. When the cannon were roaring within hearing of the citizens, and a hostile army threatened them with the most fearful calamities, not a single voice was raised in the chamber in favour of the Bourbons. The representatives continued to meet till the 8th July, when the allied troops being in possession of Paris in virtue of a capitulation, the doors of the chamber were shut, and the deputies excluded by an armed force. The allies now acted with less reserve than in the former year. They avowed their determination to replace Louis on the throne by force; and in this measure the British minister concurred, in opposition to the most obvious sense of the treaty between the allied powers of 25th March, and subsequent declarations, which however were found to be nicely adapted to cover such a design by a happy equivocation in their terms (D). In every town which the allies entered they proclaimed Louis XVIII.;

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French finally defeated at Waterloo.

(D) "In this war they do not desire to interfere with any legitimate right of the French people. They have no design to oppose the claim of that nation to choose their own form of government, or intention to trench in any respect upon their independence as a great and free people. However general the feelings of the sovereigns may

France. 1815. XVIII.; and he returned to Paris with their baggage, and surrounded with their bayonets, on the 8th of July. Negociations for peace now commenced, and were prolonged to the 20th November, when the second treaty of Paris was concluded. The terms of this treaty were more humiliating to the vanquished party than those of 1814. Some small portions of territory were detached from France. The works of art collected in the Louvre from Italy and Germany, which she had been allowed to retain by the treaty of 1814, were restored to their original owners. France was to pay to the allies seven hundred millions of francs, as an indemnity for the expence of the campaign, and to provide for 150,000 of the allied troops, who were stationed on her northern frontier under the duke of Wellington, to keep down any renewed attempts at revolution. These troops were only removed in 1818.

563 Bonaparte surrenders himself to the British. The ex-emperor after the resignation of his authority, proceeded to Rochfort, with the view of sailing to America. But finding all chance of escape precluded by the vigilance of the British squadron, he left the port in a small vessel, and surrendered himself a prisoner to Captain Maitland of the Bellerophon, on the 15th July. After being exhibited in Torbay for some days to wondering crowds, he was removed to St Helena, where he has since continued, and is likely during the remainder of his life to continue to live—a monument of the mutability of fortune, and the instability of earthly grandeur.

Shortly after the king was re-established, he dissolved the chamber of deputies, and convoked a new chamber; having previously caused his prefects fill up the vacancies in the electoral colleges, which should have been filled up by the primary assembly; in other words, having nominated a great proportion of the electors. By this infamous juggle, the chamber was filled with a set of furious ultra-royalists, who outdid the king himself in a zeal for prerogative, and disgraced the name of representatives by clamouring for the restoration of absolute power. A violent reaction naturally followed; the press was again subjected to a censorship; the protestants in the south were harassed and persecuted; their houses were burned, and 240 murdered in cold blood. Louis, who soon became sensible that the ultra zeal of the deputies was multiplying his dangers, prudently dissolved the chamber again in 1816, and convoked another, in which a more moderate spirit prevailed. Since this period the only changes of importance which have taken place in France are those made in the charter, of which some account has already been given.

566 Climate of France. In a country so extensive as that of France, it is not to be expected that the climate should be invariably the same; but it is certainly clearer and more salubrious upon the whole than that of Britain, and it is admirably adapted to the cultivation of the vine, without which many parts of it would perhaps continue in a state of nature. The country presents to the eye a level appearance in general; but several mountains are met with in the southern parts of it, such, for example, as Auvergne, Languedoc, Dauphiné, and Provence. Some reckon the Limousin the most beautiful province in France, although many parts of it besides this exhibit a charming diversity of hills and valleys, and some of the rivers, but the Seine in particular, often assume a picturesque appearance. It cannot be said that agriculture has attained to the perfection which it has done in Britain; yet in different provinces the cultivation of the ground seems to keep pace with its fertility, and the husbandmen of others display a degree of industry which is deserving of commendation. As a striking proof of this, many mountains of the Cevennes, only remarkable for their sterility, have been rendered extremely fertile by the indefatigable exertions of industry.

The most remarkable rivers of France are commonly reckoned four in number, the Seine, Loire, Rhone, and the Garonne, although there are many others of inferior note. The Seine is universally allowed to be a beautiful river, which takes its rise in the department of Cote d'Or, and, after traversing a country of about 250 miles in extent, falls into the English channel at Havre de Grace. The source of the Loire is in Mont Gerbier, in what was formerly called Languedoc, and after running about 500 miles, empties itself into the sea beyond Nantes. The Rhone rises from the Glacier of Furea, and the Garonne in the vale of Arau in the Pyrenees. The inferior rivers are the Saone, Dordogne, and a number of lesser streams which form a junction with the Loire.

There are numerous mountains in France, but there are none which are of a great height. The chain of the Vosges, in the east, about twenty or thirty miles from the Rhine, has an elevation not exceeding 4600 feet. Those of Brittany consist chiefly if not wholly of granite, but there is nothing remarkable in their elevation. France is divided from Switzerland by Mont Jura; but the principal chain of mountains is that denominated Cevennes, running from north to south, and sending out ramifications from east to west. Some naturalists are of opinion, that certain volcanic appearances may be traced among the mountains in the departments of Cantal and the Upper Loire; but the basaltic columns of which they chiefly consist, either do not favour this conjecture, or leave the truth of it extremely problematical. The loftiest mountains in France are those called Monts d'Or, which constitute the centre, of which Puy de Sansi forms the chief elevation, its height being computed at 6300 feet above the level of the sea. This mountain is covered a great part of the year with snow, and from its sides issues the river Dordogne.

The Pyrenees have been known and celebrated in history since the time of Herodotus, and may with equal propriety be considered as belonging either to France or Spain; although they have been more ably and minutely described by the learned of the former country. Shells and skeletons of animals have been found among the Pyrenees, which may afford matter for ample discussion to the admirers of nature's productions. Marine productions

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may be in favour of the restoration of the king, they no otherwise seek to influence the proceedings of the French, in the choice of this or any other dynasty or form of government, than may be essential to the safety or permanent tranquillity of Europe." *Lord Clancarty's Despatch, dated Vienna, 6th May 1815.*

productions have been discovered on the top of Mont Perdu, which it is extremely difficult to ascend, because, in many places, it is almost perpendicular for nearly 900 feet; and near the summit there is a lake about 9000 feet above the level of the sea.

There are many forests in France, and of considerable extent, to the growth of which it becomes of importance to attend, as the chief fuel which the inhabitants can command is wood. The largest forests are those of Orleans and Ardennes, but our limits forbid us to give an ennmeration of the rest, which could answer no important purpose.

Of the botanical state of this country nothing can be advanced with certainty; for although its prodnctions of this nature may be said to have been examined around Paris, Lyons, and Montpelier, with considerable accuracy, yet mnch is still wanting to furnish any thing like a complete history of its vegetables. We have no certain accounts of what are purely indigenous or what are exotic, although the former must be more abundant in France than in any other European country.

The horses of this country are certainly inferior to those of Britain; and in former times its monarchs were drawn by oxen to the national assemblies. Their cattle are of a beautiful cream colour, but their sheep are much inferior to the English, owing, perhaps, to their wretchedly ill management, their meat being straw during the winter season instead of green food. France in some places is infested by the wild boar and the wolf, while the ibex and chamois inhabit the Pyrenees and the Alps.

At one period there were gold mines in the southern parts of France, and particles of that precious metal are still to be found in some of the rivulets. There are mines of silver in Alsace, and mines of copper in the departments of the Alps. The duchy of Deux Ponts contains mines of mercury; antimony is found in Ardeche; and abundance of iron, the most extensively useful of all the metals, is met with in the northern departments, for the working of which there were computed to be 2000 furnaces employed in the year 1798. 572 Minerals.

The population of France was estimated at 26,363,000 in 1791. In 1817 it amounted to 29,327,000. Our readers will find a pretty accurate account of it by inspecting the following table, which exhibits the number contained in each department, according to the division adopted since the revolution. 573 Population.

Ancient Provinces.	*Departments.*	*Population.*	*Chief Towns.*
Flandre Françoise.	Nord.	899,890	Douai.
Artois.	Pas-de-Calais.	580,457	Arras.
Picardie.	Somme.	495,058	Amiens.
Normandie.	Seine Inferieure.	642,948	Rouen.
	Calvados.	505,420	Caen
	Manche.	583,429	Coutances.
	Orne.	425,920	Alençon.
	Eure.	421,581	Evreux.
Isle de France.	Seine.	780,000	Paris.
	Seine and Oise.	439,972	Versailles.
	Oise.	383,500	Beauvais.
	Aisne.	442,989	Laon.
	Seine and Marne.	304,068	Melun.
Champagne.	Marne.	311,037	Chalons-sur-Marne.
	Ardennes.	275,792	Mezieres.
	Aube.	238,819	Troyes.
	Haute Marne.	237,785	Chammont.
Lorraine.	Meuse.	284,703	Bar-sur-Ornain.
	Moselle.	385,949	Metz.
	Meurthe.	365,810	Nancy.
	Vosges.	334,169	Epinal.
Alsace.	Haut-Rhin.	318,577	Colmar.
	Bas-Rhin.	391,642	Strasbourg.
Bretagne.	Isle and Vilaine.	508,544	Rennes.
	Cotes-du-Nord.	519,620	St Brieux.
	Finisterre.	452,895	Quimper.
	Morbihan.	403,423	Vannes.
	Loire Inferiure.	407,900	Nantes.
Maine and Perche.	Sarthe.	410,380	Le Mans.
	Mayenne.	332,550	Laval.
Anjou.	Mayenne and Loire.	403,864	Angers.
Touraine.	Indre and Loire.	275,292	Tours.
Orleannois.	Loiret.	286,153	Orleans.
	Eure and Loire.	265,996	Chartres.
	Loire and Cher.	212,552	Blois.
	Indre.	204,271	Chateauroux.
Berri.	Cher.	228,158	Bourges

France.

Ancient Provinces.	Departments.	Population.	Chief Towns.
Nivernois. . . .	Nievre.	241,520	Nevers.
Bourgogne. . . .	Yonne.	325,994	Auxerre.
	Cote d'Or.	354,436	Dijon.
	Saone and Loire.	471,457	Maçon.
	Ain.	304,668	Bourg.
Franche-Compté. . .	Haute-Saone.	300,156	Vesoul.
	Doubs.	240,792	Besançon.
	Jura.	292,882	Lons-le-Saunier.
Poitou.	Vendée.	268,686	Fontenoy-le-Peuple.
	Deux-Sevres.	254,105	Niort.
	Vienne.	253,048	Poitiers.
Marche. . . .	Haut-Vienne.	243,195	Limoge.
	Creuze.	226,224	Guèret.
Limosin. . . .	Correze.	254,271	Tulle.
Bourbonnois. . . .	Allier.	260,266	Moulins.
Saintonge and Aunis. .	Charente-Inferieure.	293,011	Saintes.
Angoumois and part of Saintonge.	Charente.	326,985	Angouleme.
Auvergne. . . .	Puy-de-dôme.	548,834	Clermont.
	Cantal.	251,436	St Flour.
Lyonnois, Foret and Beaujolois.	Rhone.	347,381	Lyons.
	Loire.	315,858	Montbrison.
	Isere.	471,660	Grenoble.
Dauphiné.	Hautes-Alpes.	121,771	Gap.
	Drome.	253,372	Valence.
Guyenne, comprehending Gascogne. . . .	Dordogne.	424,113	Perigueux.
	Gironde.	514,562	Bourdeaux.
	Lot and Garonne.	326,150	Agen.
	Lot.	268,150	Cahors.
	Aveyron.	331,373	Rhodez.
	Gers.	286,493	Auch.
	Landes.	235,550	Mont-de-Marsan.
	Hautes-Pyrenees.	198,763	Tarbe.
Bearn.	Basses-Pyrenees.	383,502	Pau.
Comté-de-Foix . . .	Arriege.	222,936	Tarascon.
Roussillon. . . .	Pyrenees-Orientales.	126,625	Perpignan.
Languedoc. . . .	Haute-Garonne.	367,550	Toulouse.
	Aude.	240,993	Carcassonne.
	Tarn.	295,885	Castres.
	Garde.	322,144	Nismes.
	Lozere.	143,347	Mende.
	Ardeche.	290,833	Privas.
	Haute-Loire.	268,202	Le Puy.
	Heraut.	301,099	Montpellier.
Provence.	Bouches-du-Rhone.	293,935	Aix.
	Basses-Alpes.	146,994	Digne.
	Var.	283,296	Toulon.
Venaissin. . . .	Vaucluse.	205,832	Avignon.
Corsica.	Corsica.	174,702	Bastia.

574 Religion, &c.

The established religion is that of the church of Rome, but entirely independent of the Holy see; and the revenues of the clergy are not so extensive as to render them formidable to the preservation of the state. Of its political constitution, as that is an ignis fatuus which eludes all description, little need be said.

Army.

Subsequent to the revolution, it was perhaps impossible to give a just account of the strength of the French army, for both themselves and their enemies made it more numerous than it really was, although both parties must have been actuated by very different motives. The numerous defeats which the allies experienced, rendered it necessary to speak of their antagonists as a never-

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France. never-to-be-diminished swarm of men, and the French no doubt gave exaggerated reports of their own actual strength, in order to intimidate the allies. In the time of the old government, the army amounted to 170,000 infantry, 44,000 cavalry, and 11,000 artillery; and perhaps at no period of the revolution did it ever exceed 600,000 men, although it has been often magnified to
576 Navy. the prodigious total of a million. Since the restoration of the Bourbons, the army has been about 140,000, the annual expence of which is abont six millions sterling.

The naval power of France was once formidable even to Britain: but the decided superiority in this respect has been invariably possessed by the latter country ever since the battle of La Hogue.

577 Revenue. The revenue of France, immediately before the revolution, has been estimated at twenty-two millions sterling. The amount during Bonaparte's reign, it is believed, was never honestly stated. In 1820, it was estimated at thirty millions. The public debt, funded and unfunded, in 1814, was one hundred and twenty-three millions, and the interest seven millions.

578 Learning. With respect to literature, France certainly holds a distinguished place among the nations of Europe; and if the palm has been adjuged to Italy and Britain by some authors, in point of bold invention and profound philosophical speculations, French authors are to be met with in great abundance who have done honour to human nature by their polite learning, and elegant as well as useful science. Altogether independent of a Corneille, a Racine, a Crebillon, a Moliere, or a Voltaire, this country has, at a more modern period, produced many distinguished writers in literature and philosophy, whose productions will continue to be read and admired, so long as men retain a sense of the value and importance of the sciences they respectively illustrate.

At one period there were no fewer than 21 universities in France, of which the Sorbonne at Paris was reputed the most celebrated, the fame of which drew numbers of students from distant countries. There were about 39 academies and literary societies, which produced many elegant and valuable dissertations on the different sciences, which have been long known to, and justly esteemed by, the learned world.

579 Cities &c. The cities of France are very numerous, and many of them make a most conspicuous figure. Paris, which is still the metropolis, has been sometimes reckoned a third smaller than London, and its population stated at 713,000 souls. It has often been considered as superior to London in point of magnificence, but it is undoubtedly inferior both in regard to convenience and cleanliness, the streets in general having very poor accommodations for passengers on foot;—a defect for which no elegance or magnificence can fully compensate. The next to Paris in importance, is the city of Lyons, the population of which is computed at 101,000: the desolation which it suffered during the tremendous reign of Jacobin fury it has since recovered. The abolition of monarchy was the innocent cause of much injury to its trade, which consisted chiefly in the manufacture of such splendid articles as were consumed by the court.

Next to Lyons we may mention Marseilles and Bourdeaux, of which the former contains 100,000 people, the latter 92,000. The port of the former city is perhaps the best, as well as the most frequented, of any in the Mediterranean. Lisle and Valenciennes are both strongly fortified cities, the former of which has a population of about 60,000. It surrendered to the combined powers in the year 1793, but the French retook it in the following year. The remaining cities, of which we can only give a bare enumeration, are Amiens, Rouen, Brest, Nantes, Orleans, Nancy, Metz, Strasbourg, Toulouse, Montpelier, &c. none of them having a population under 30,000 souls, many of them carrying on an extensive trade, and all of them abounding with elegant buildings.

Many exertions have been made at different periods, 580 Canals. to improve the inland navigation of France. The great Henry IV. began the celebrated canal of Burgundy, which was finished by Louis XIII. and by which a communication is opened between the rivers Loire and Seine. It consists of 42 locks, and is of singular importance to the commerce of the western provinces. The canal of Picardy reaches from the river Somme to the Oise, taking its rise from St Quintin, and affording an intercourse to the provinces lying on the north-east. But the greatest and most expensive work of this nature in France, which was begun and finished by Louis XIV. is the canal of Languedoc, which was completed in 15 years. It is 144 feet broad, six feet deep, and about 180 miles long; and it cost upwards of half a million sterling.

The total amount of the exports of France in the 581 Trade. year 1784, exclusive of the provinces of Lorraine and Alsace, and the trade with the West Indies which has been since carried on, was 307,151,700 livres, and her imports 271,365,000. The exports in 1789 were estimated at 613,000,000 livres, and the imports at 448,000,000. Since the restoration of the Bourbons, in 1818, the exports have been stated in the French journals at 15,400,000l. sterling. See the article FRANCE, in the SUPPLEMENT, in which a full view is given of the statistics of the country.

France, Francfort. *Isle of FRANCE*, a late province of France, but now divided into five departments, and so called, because it was formerly bounded by the rivers Seine, Marne, Oise, Aisne, and Ourque. It comprehends, besides Paris, the Beauvoisis, the Valois, the county of Senlis, the Vexin, and Hurepois, the Gatinois, the Multien, the Goele, and the Mantois. Paris is the capital.

FRANCFORT *on the MAINE*, an imperial and hanseatic town of Franconia in Germany, where the emperors were formerly elected. It is a handsome, strong, rich place, and has a great deal of commerce. Here the golden bull is preserved, which is the original of the fundamental laws of the empire. It is seated in a fine fertile plain; and well fortified with a double ditch, bastions, redoubts, and ravelins. The streets are remarkably wide, and the houses handsomely built.

Since 1815 it has been the permanent seat of the German diet. The number of inhabitants is 41,000; and it is one of the four towns which still retain their privileges. It was taken in October 1792, by the French, who were dispossessed of it by the Prussians in December following; it was again taken by the French in July 1796, but they evacuated it to the Austrians in September following. The suburb is called *Saxonhausen*, and joined to the town by a stone bridge built over the Maine. E. Long. 8. 37. N. Lat. 50. 7.

Francfort on the Oder, a rich and handsome town of Germany, in the middle marche of Brandenburgh, formerly imperial, but now subject to the king of Prussia. It is remarkable for three great fairs, and a celebrated university; and was taken by the French in 1806. It lies about 45 miles south-east of Berlin, and 72 south of Stetin. E. Long. 14. 45. N. Lat. 52. 22.

FRANCHE-COMPTE, a late province of France, bounded on the south and west by Champagne and Burgundy; on the north by Lorrain; and to the east by the earldom of Mumplegard, and Switzerland. It is in length from north to south about 30 leagues; in breadth about 20. It is partly flat and partly hilly. The flat country is fruitful in grain, wine, hemp, and pasture; and the hilly country abounds in cattle, producing also some wine and corn, copper, lead, iron, and silver ores, mineral waters, and quarries of stone, marble, and alabaster. It now forms the three departments of Doubs, Jura, and Upper Saone.

FRANCHISE, in *Law*. *Franchise* and *liberty* are used as synonymous terms; and their definition is, "a royal privilege, or branch of the king's prerogative, subsisting in the hands of a subject." Being therefore derived from the crown, they must arise from the king's grant; or in some cases may be held by prescription, which, as has been frequently said, presupposes a grant. The kinds of them are various, and almost infinite. We shall here briefly touch upon some of the principal, premising only, that they may be vested in either natural persons or bodies politic; in one man, or in many: but the same identical franchise, that has before been granted to one, cannot be bestowed on another, for that would prejudice the former grant.

To be a county palatine, is a franchise vested in a number of persons. It is likewise a franchise for a number of persons to be incorporated and subsist as a body politic; with a power to maintain perpetual succession, and do other corporate acts: and each individual member of such corporation is also said to have a franchise or freedom. Other franchises are, to hold a court leet; to have a manor or lordship; or, at least, to have a lordship paramount; to have waifs, wrecks, estrays, treasure-trove, royal fish, forfeitures, and deodands; to have a court of one's own, or liberty of holding pleas and trying causes; to have the cognizance of pleas; which is still a greater liberty, being an exclusive right, so that no other court shall try causes arising within that jurisdiction: to have a bailiwick, or liberty exempt from the sheriff of the county; wherein the grantee only, and his officers, are to execute all process: to have a fair or market; with the right of taking toll, either there or at any other public places, as at bridges, wharfs, or the like: which tolls must have a reasonable cause of commencement (as in consideration of repairs, or the like), else the franchise is illegal and void: or lastly, to have a forest, chase, park, warren, or fishery, endowed with privileges of royalty. See Chase, Forest, &c.

Franchise is also used for an asylum or sanctuary, where people are secure of their persons, &c. Churches and monasteries in Spain are franchises for criminals; so were they anciently in England, till they were abused to such a degree that there was a necessity for abolishing the custom. One of the most remarkable capitulars made by Charlemagne in his palace of Heristal, in 779, was that relating to the franchises of churches. The right of franchise was held so sacred, that even the less religious kings observed it to a degree of scrupulousness; but to such excess in time was it carried, that Charlemagne resolved to reduce it. Accordingly he forbade any provision being carried to criminals retired into churches for refuge.

Franchise of Quarters, is a certain space or district at Rome, wherein are the houses of the ambassadors of the princes of Europe; and where such as retire cannot be arrested or seized by the sbirri or serjeants, nor prosecuted at law. The people of Rome look on this as an old usurpation and a scandalous privilege, which ambassadors, out of a jealousy of their power, carried to a great length in the 15th century, by enlarging insensibly the dependencies of their palaces or houses, within which the right of franchise was anciently confined. Several of the popes, Julius III. Pius XIV. Gregory XIII. and Sixtus V. published bulls and ordinances against this abuse; which had rescued so considerable a part of the city from their authority, and rendered it a retreat for the most abandoned persons. At length Innocent XI. expressly refused to receive any more ambassadors but such as would make a formal renunciation of the franchise of quarters.

FRANCIS I. king of France, the rival of the emperor Charles V. and the restorer of learning and politeness in France. See (*History of*) France.

Francis, *Philip*, a very ingenious writer, of Irish extraction, if not born in that kingdom. His father was a dignified clergyman in Ireland, being dean of some cathedral; and our author, his son, was also bred to the church, and had a doctor's degree conferred on him. He was more distinguished as a translator than as an original writer. His versions of Horace and Demosthenes have been justly valued: the former is accompanied with notes, and is perhaps as complete and useful a work of its kind as hath yet appeared. He was also a considerable political writer; and in the beginning of the present reign is supposed to have been employed by the government: for which service he was promoted to the rectory of Barrow in Suffolk, and to the chaplainship of Chelsea hospital. He was also the author of two tragedies, Eugenia and Constantia; but as a dramatic writer, not very successful. He died at Bath in March 1773; leaving a son, who was then one of the supreme council at Bengal.

FRANCISCANS, in *Ecclesiastical History*, are religious of the order of St Francis, founded by him in the year 1209. Francis was the son of a merchant of Assisi, in the province of Umbria, who, having led a dissolute life, was reclaimed by a fit of sickness, and afterwards fell into an extravagant kind of devotion, that

that looked less like religion than alienation of mind. Soon after this, viz. in the year 1208, hearing the passage repeated, Mat. x. 9. 10. in which Christ addresses his apostles, *Provide neither gold, nor silver*, &c. he was led to consider a voluntary and absolute poverty as the essence of the gospel, and to prescribe this poverty as a sacred rule both to himself and to the few that followed him. This new society, which appeared to Innocent III. extremely adapted to the present state of the church, and proper to restore its declining credit, was solemnly approved and confirmed by Honorius III. in 1223, and had made considerable progress before the death of its founder in 1226. Francis, through an excessive humility, would not suffer the monks of his order to be called *fratres*, i. e. brethren or friars, but *fraterculi*, i. e. little brethren, or friars-minor, by which denomination they still continue to be distinguished. They are also called *gray friars*, on account of the colour of their clothing, and *cordeliers*, &c. The Franciscans and Dominicans were zealous and active friends to the papal hierarchy, and, in return, were distinguished by peculiar privileges and honourable employments. The Franciscans, in particular, were invested with the treasure of ample and extensive indulgences; the distribution of which was committed to them by the popes, as a means of subsistence, and a rich indemnification for their voluntary poverty. In consequence of this grant, the rule of the founder, which absolutely prohibited both personal and collective property, so that neither the individual nor the community were to possess either fund, revenue, or any worldly goods, was considered as too strict and severe, and dispensed with soon after his death. In 1231, Gregory IX. published an interpretation of this rule, mitigating its rigour; which was farther confirmed by Innocent IV. in 1245, and by Alexander IV. in 1247. These milder operations were zealously opposed by a branch of the Franciscans called the *spiritual;* and their complaints were regarded by Nicholas III. who, in 1279, published a famous constitution, confirming the rule of St Francis, and containing an elaborate explication of the maxims it recommended, and the duties it prescribed. In 1287, Matthew of Aqua Sparta, being elected general of the order, discouraged the ancient discipline of the Franciscans, and indulged his monks in abandoning even the appearance of poverty; and this conduct inflamed the indignation of the spiritual or austerer Franciscans; so that from the year 1290 seditions and schisms arose in an order that had been so famous for its pretended disinterestedness and humility. Such was the enthusiastic frenzy of the Franciscans, that they impiously maintained that the founder of their order was a second Christ, in all respects similar to the first; and that their institution and discipline were the true gospel of Jesus. Accordingly, Albizi, a Franciscan of Pisa, published a book in 1383, with the applause of his order, entitled, The book of the Conformities of St Francis with Jesus Christ. In the beginning of this century, the whole Franciscan order was divided into two parties; the one embracing the severe discipline and absolute poverty of St Francis, were called *spirituals;* and the other, who insisted on mitigating the austere injunctions of their founder, were denominated *brethren of the community*. These wore long, loose, and good habits, with large hoods; the former were clad in a strait, coarse, and short dress, pretending that this dress was enjoined by St Francis, and that no power on earth had a right to alter it. Neither the moderation of Clement V. nor the violence of John XXII. could appease the tumult occasioned by these two parties; however, their rage subsided from the year 1329. In 1368 these two parties were formed into two large bodies, comprehending the whole Franciscan order, which subsist to this day; viz. the *conventual brethren*, and the *brethren of the observance* or *observation*, from whom sprung the capuchins and recollects. The general opinion is, that the Franciscans came into England in the year 1224, and had their first house at Canterbury, and their second at London; but there is no certain account of their being here till King Henry VII. built two or three houses for them. At the dissolution of the monasteries, the conventual Franciscans had about 55 houses, which were under seven custodies or wardenships; viz. those of London, York, Cambridge, Bristol, Oxford, Newcastle, and Worcester.

FRANCOIS, or FRANCAIS, *Port Des*, the name of a bay or harbour discovered by Peyrouse on the north-west coast of America, is situated in N. Lat. 58. 37. and in Long. 139. 50. W. from Paris. This harbour was from three to four leagues deep: he entered it with his two frigates in July 1786, and came to an anchor in an island near the middle of it, in 20 fathoms water, with a muddy bottom. The bottom of the bay, he observes, is one of the most extraordinary places in the world; the water is so deep that it could not be fathomed, and surrounded by peaked mountains of a great height, covered with snow, without vegetation, and seemingly condemned by nature to perpetual sterility. He never saw the surface of the water ruffled with the smallest breath of air, or in the least disturbed but by the falling of enormous pieces of ice, which continually detach themselves from five different glaciers. The air was so calm, and the silence so profound, that the voice of a man might be heard at the distance of half a league, as well as the noise of sea-birds which hatch their eggs in the cavities of the rocks.

He found the variation of the compass to be 28° E. and the dip of the needle 74°. At full and change of the moon, when it is high water at one o'clock, the sea rose seven feet and a half. The current of the channel at the entrance of the harbour, during the sea breeze, came in like a rapid river, so that it must be impracticable to take the channel when the winds blow violently from the southward; and indeed the currents at all times render the entrance difficult. This harbour possesses many advantages, but it is also subject to several inconveniences. It seems not to be convenient for ships to anchor, which are employed in trafficking in skins, because such ships ought to enter many bays, making in each a short stay, since the whole stock of the Indians is very soon disposed of; but it seems to be a very commodious place for the establishment of a factory, and this commercial settlement, it is suggested, should be made on Cenotaph island, a name given to an island in the middle of the harbour, from the monument erected on it to the memory of some of the crew of Peyrouse's ships, which were lost in the channel. This island is about a league in circumference, abounds with wood and water, and seems capable of cultivation. The quantity

tity of otter skins far exceeded any thing which Peyrouse had observed in any other part of America.

The climate of this coast, according to Peyrouse, seemed much milder than that of Hudson's Bay. For three or four months of the year vegetation was very vigorous; there was found abundance of celery, endive, lupin, and yarrow, with most of the plants which are common in the meadows and mountains of France. Gooseberries, raspberries, and strawberries, were also common in the woods; poplars, willows, hornbeam, and pines, some of which measured six feet in diameter, and 140 feet high, fit for masts of the largest ships. The river seemed to be filled with trout and salmon, and different kinds of fish were found in the bay itself. The variety of birds was not great; but bears, martens, and squirrels, were frequent in the woods. The inhabitants are said to be considerably different from the Californians, being taller, stouter, of a more agreeable figure, having greater vivacity of expression, and a greater share of courage and sense. Their colour is olive, and the hair in general is neither so coarse nor black as that of the South Americans. It is supposed that they are worshippers of the sun, for they were frequently observed addressing themselves in their prayers to this planet; but neither temple nor priest, nor trace of public worship, was seen. It is said that they burn their dead.

FRANCONIA, a circle of Germany, bounded on the north by the circle of Upper Saxony, on the east by that of Bavaria, on the south by that of Swabia, and on the west by the circles of the Rhine. The middle is fertile in corn, wine, and fruits, but the borders are full of woods and barren mountains.

This country was overrun by the French republicans in the summer of 1796; but in September the Austrians compelled them to retreat. The Franks, who conquered France, came from this province, and gave their name to this kingdom.

FRANGULA. See RHAMNUS, BOTANY *Index*.

FRANK LANGUAGE, *Lingua Franca*, a kind of jargon spoken on the Mediterranean, and particularly throughout the coasts of and ports of the Levant, composed of Italian, Spanish, French, vulgar Greek, and other languages.

FRANK, or *Franc*, an ancient coin, either of gold or silver, struck and current in France. The value of the gold frank was something more than that of the gold crown: this coin has been long out of use, though the name is still retained as the name of a money of account: in which sense it is equivalent to the livre, or 20 sols.

FRANK, or *Franc*, meaning literally *free* from charges and impositions, or exempt from public taxes, has various significations in the ancient English customs.

FRANK-Almoigne, (*libera eleemosyna*), or "free alms;" a tenure of a spiritual nature, whereby a religious corporation, aggregate or sole, holdeth lands of the donor to them and their successors for ever. The service which they were bound to render for these lands was not certainly defined: but only in general to pray for the souls of the donor and his heirs, dead or alive; and therefore they did no fealty (which is incident to all other services but this), because this divine service was of a higher and more exalted nature. This is the tenure by which almost all the ancient monasteries and religious houses held their lands; and by which the parochial clergy, and very many ecclesiastical and eleemosynary foundations, hold them at this day; the nature of the service being upon the Reformation altered, and made conformable to the purer doctrines of the church of England. It was an old Saxon tenure; and continued under the Norman revolution, through the great respect that was shown to religion and religious men in ancient times. This is also the reason that tenants in frank almoigne were discharged of all other services except the *trinoda necessitas*, of repairing the highways, building castles, and repelling invasions; just as the Druids, among the ancient Britons, had *omnium rerum immunitatem*. And even at present, this is a tenure of a very different nature from all others; being not in the least feodal, but merely spiritual. For, if the service be neglected, the law gives no remedy by distress, or otherwise, to the lord of whom the lands are holden; but merely a complaint to the ordinary or visitor to correct it.

FRANK-Chase is defined to be a liberty of free chase, whereby persons that have lands within the compass of the same, are prohibited to cut down any wood, &c. out of the view of the forester.

FRANK-Fee, signifies the same thing as holding lands and tenements in fee-simple; that is, to any person and his heirs, and not by such service as is required by ancient demesne, but is pleaded at common law. See FEE.

FRANK-Law, a word applied to the free and common law of the land, or the benefit a person has by it.

He that for any offence loseth this frank-law incurs these inconveniences, viz. He may not be permitted to serve on juries, nor used as an evidence to the truth; and if he has any thing to do in the king's court, he must not approach it in person, but appoint his attorney; his lands, goods, and chattels, shall be seized into the king's hands; and his lands be estreated, his trees rooted up, and his body committed to custody.

FRANK-Marriage, in *Law*, is where tenements are given by one man to another, together with a wife, who is the daughter or cousin to the donor, to hold in frank-marriage. By such gift, though nothing but the word *frank-marriage* is expressed, the donees shall have the tenements to them, and the heirs of their two bodies begotten; that is, they are tenants in special tail. For this one word, *frank marriage*, denotes *ex vi termini*, not only an inheritance, like the word *frank-almoigne*, but likewise limits that inheritance; supplying, not only words of descent, but of procreation also. Such donees in frank-marriage are liable to no service but fealty: for a rent reserved therein is void until the fourth degree of consanguinity be past between the issues of the donor and donee.

FRANK-Pledge, in *Law*, signifies a pledge or surety for the behaviour of freemen.

According to the ancient custom of England, for the preservation of the public peace, every freeborn man, at the age of fourteen, except religious persons, clerks, knights, and their eldest sons, was obliged to give security for his truth and behaviour towards the king and his subjects, or else be imprisoned. Accordingly, a certain number of neighbours became interchangeably bound

bound for each other, to see each person of their pledge forthcoming at all times, or to answer for the offence of any one gone away: so that whenever any person offended, it was presently inquired in what pledge he was, and there the persons bound either produced the offender in 31 days, or made satisfaction for his offence.

Frank-Tenement. See Tenure.

FRANKED letters. The privilege of letters coming free of postage to and from members of parliament was claimed by the house of commons in 1660, when the first legal settlement of the present post office was made; but afterwards dropped, upon a private assurance from the crown, that this privilege should be allowed the members. And accordingly a warrant was constantly issued to the postmaster general, directing the allowance thereof to the extent of two ounces in weight: till at length it was expressly confirmed by 4 Geo. III. c. 24. which adds many new regulations, rendered necessary by the great abuses which had crept into the practice of franking; whereby the annual amount of franked letters had increased from 23,600l. in the year 1715, to 170,700l. in the year 1763. Further regulations have since taken place; in particular, franks must be dated (the month written at length), and put into the office the same day; notwithstanding which, the revenue still loses by this privilege a very considerable annual sum.

FRANKEN, Franciscus, commonly called *Old Frank*, a famous Flemish painter, supposed to have been born about the year 1544; but though his works are well known, very few of the circumstances of his life have been transmitted to posterity. This master painted historical subjects from the Old and New Testaments; and was remarkable for introducing a great number of figures into his compositions, which he had the address to group very distinctly. Vandyck often commended his works, and thought them worthy of a place in any collection.

Franken, *Franciscus*, distinguished by the name of *Young Frank*, was the son of the former, born in the year 1580. He was instructed by his father; whose style he adopted so closely, that their works are frequently mistaken. When he found himself sufficiently skilled at home, he travelled into Italy for improvement in colouring; and, on his return, his works were much coveted. The most capital performances of this painter are, a scriptural performance in the church of Notre Dame at Antwerp; and an excellent picture, in a small size, of Solomon's idolatry. Young Frank died in 1642.

FRANKENDAL, a strong town of Germany, in the dominions of the Elector Palatine, situated near the Rhine, about seven miles south of Worms. It was taken by the Spaniards in 1623, by the Swedes in 1632, burnt by the French in 1688, and finally taken by the allies in the year 1794. E. Long. 8. 29. N. Lat. 49. 25.

FRANKENIA, a genus of plants belonging to the hexandria class; and in the natural method ranking under the 17th order, *Calycanthemæ*. See Botany *Index*.

FRANKFORT, the name of several townships in different places of North America; such as Frankfort, a township in Hancock, and district of Maine, with a few houses regularly built. It contains 891 inhabitants, and lies about 238 miles north-east of Boston. Frankfort, a thriving village in Philadelphia; the name of another in Hampshire, of one in Virginia, and the name of the metropolis of Kentucky.

FRANKINCENSE. See Incense.

FRANKLIN, Thomas, D. D. chaplain in ordinary to his majesty, was born in London about the year 1720, and was the son of Richard Franklin, well known as the printer of an anti-ministerial paper called *The Craftsman*; in conducting which he received great assistance from Lord Bolingbroke, Mr Pulteney, and other excellent writers, who then opposed Sir Robert Walpole's measures. By the advice of the second of these gentlemen, young Franklin was devoted to the church, with a promise of being provided for by the patriot; who afterwards forgot his undertaking, and then entirely neglected him. He was educated at Westminster school; from whence he went to the university of Cambridge, where he became fellow of Trinity college, and was some time Greek professor. In December 1758, he was instituted vicar of Ware and Thundridge; which, with the lectureship of St Paul, Covent Garden, and a chapel in Queen street, were all the preferments he held till he obtained the rectory of Brasted in Kent. This gentleman was possessed of no inconsiderable share of learning and poetical abilities, and was long a favourite in the literary world. His translations of Phalareus, Sophocles, and Lucian, equally evince his learning and his genius, as they are not more distinguished for fidelity in the version, than congeniality with the spirit of the admirable originals. Dr Franklin, like Mr Foote, suffered a translation from the French to be printed in his name; but the Orestes and Electra are supposed to be all that were really by him. It was a translation of Voltaire's works, to which also Dr Smollett's name appears. His own dramatic compositions, of which the principal are the tragedies of The Earl of Warwick and Matilda, are universally known, and deservedly esteemed by the public. He died in March 1784.

Franklin, *Benjamin*, a philosopher and a statesman of considerable eminence, was born in the year 1706, at Boston in New England. His family derived their origin from Ecton in Northamptonshire, where his ancestors had an inconsiderable freehold for many generations. The persecution of the non-conformists in the reign of Charles II. induced his father to take refuge in New England; and in the city of Boston he followed the occupation of a soap-boiler and tallow-chandler. Franklin drew up a history of his own life from his nativity to the 25th year of his age; but as at that period he had made no very conspicuous figure in the world, it is to be lamented that we have not the assistance of his own pen to the meridian of his career. This defect we have endeavoured to supply in the subsequent narrative from the most authentic materials, avoiding as much as possible the exaggerated panegyric of friends, and the unmerited detraction of enemies.

Our author, from his very infancy, discovered the strongest propensity towards literary pursuits, which determined his father to qualify him for the ministry; but he was thwarted in his designs by a numerous and increasing family, Franklin. family, and therefore Benjamin was taken from school at ten years of age, to take part in the drudgery of his father's trade. This greatly mortified the aspiring mind of young Franklin, who wished to prefer a seafaring life to such an employment; but from this he was dissuaded by the influence of his father, who was a man of some knowledge, and possessed a solid understanding. He made it his chief aim to inspire his children with the love of knowledge and the principles of moral rectitude. He had few books; yet from among these Benjamin selected a number of voyages and travels, as well as different histories, a species of reading for which he had a strong predilection. By going through a course of controversial divinity in this unaided manner, he greatly strengthened his argumentative powers, which was most probably all he had in view. Defoe upon Projects, according to his own account, made such impressions upon his mind as in a great measure directed the subsequent events of his life.

He was now chosen to an employment which accorded much better with the natural bent of his mind than the business of his father's shop. A brother of his own had a printing-office in Boston, to whom Benjamin was bound apprentice at 12 years of age. With the mechanical part of the business he was soon acquainted; and the opportunities thus afforded him of procuring new books to read, were eagerly seized, and the greater part of the night frequently spent in the perusal of them. He soon became anxious to imitate the works which he most admired, and his first attempts were of a poetical nature. He composed and printed ballads, which were well received by those who love such a species of reading; yet his father had the address to convince him that nature never designed him for a poet. He therefore turned his whole attention to the cultivation of prose composition, in which he succeeded infinitely better; and he thus became superior to his brethren of the press, and raised himself to stations of public importance. As his passion for reading and writing was very strong, so he became in a short time a powerful disputant, which was strengthened by his intimacy with a young man of a similar disposition. He perused, with uncommon attention, a translation of Xenophon's Memorabilia, which enabled him either to confute or confound an adversary by a number of questions. It is also certain that he became a sceptic as to the religion in which he had been educated, and propagated his unbelief with zeal and assiduity. The fatal consequences which this produced on the deportment of some of his intimate companions, at length happily convinced him that it is extremely dangerous to destroy the salutary influence of religion, without being able to substitute any thing in its place of equal importance and efficacy. He seems, however, to have continued a sceptic in his own mind, yet he still retained a love for moral rectitude, which led him to adopt honourable means in the prosecution of valuable ends. Much to his honour be it spoken, he acquired, at a very early period of life, that triumph over his sensual appetites, which is so essentially necessary to a life of dignity, usefulness, and virtue. Having read Tyron's recommendation of a vegetable diet, at 16 years of age, he abandoned the use of animal food; and on offering to his brother to support himself on half the money which was paid for his board, he was allowed to adopt his own plan, by which means he was enabled to save a considerable sum for the purchase of books. Although he relaxed considerably as to a vegetable diet, yet he thus acquired the habit of being satisfied with little, and a contempt of the gratifications of the palate was frequently of singular advantage to him through the whole of life.

When his brother began a newspaper, Benjamin sent a number of pieces on various topics to be inserted, which met with the approbation of the most competent judges;—a satisfaction he enjoyed without being known, as they were all anonymous. His brother treated him with the harshness of a master, which he bore with the utmost impatience, as the public had already pronounced him to be possessed of merit. The states of America having prohibited James Franklin from publishing this paper, on account of some political offence, the name of Benjamin was employed as publisher, in consequence of which he procured his indentures, although he agreed privately with his brother to serve out his time. But as he did not deem this agreement obligatory, he went to New York by sea, and from that place to Philadelphia, in the seventeenth year of his age. He himself acknowledges this to have been a fault, and therefore has averted that censure which he would otherwise have deserved. At Philadelphia he engaged with a printer of the name of Keimer, whose affairs he soon placed on a more respectable footing; and here also he became acquainted with several young men of a literary turn of mind, by whose company his taste for knowledge was greatly improved.

He soon after became acquainted with Sir William Keith the governor of that province, who powerfully recommended it to him to commence business on his own account, and promised to give him all the encouragement in his power. Encouraged by this gentleman to adopt such a plan, he set out for Boston on a visit to his parents, in order to proeure from them some pecuniary aid; but a welcome reception was all he could obtain. Having returned to Philadelphia, Sir William generously offered to take the whole burden upon himself, and advised Franklin to make a voyage to England, in order to procure every thing necessary for a printing-office. He set sail in the year 1725, and took with him his intimate companion Ralph, whose name has been rendered memorable by being celebrated in the Dunciad. Unfortunately for Franklin, Sir William Keith, on whose letters of recommendation and credit he entirely relied, basely deceived him, and he was obliged to work as a journeyman in London for his immediate subsistence. His friend Ralph could only live by his head, and his income of consequence was extremely circumscribed, as well as precarious, which made him a heavy burden on the pocket of Benjamin. In that dissolute metropolis the one forgot his wife and child in America, and the other the solemn promises of fidelity which he had made to a Miss Read, prior to his departure;—another step of his conduct which he himself severely censures. By a dissertation on liberty and necessity, pleasure and pain, he acquired considerable reputation, and it was the means of introducing him to the celebrated Dr Mandeville, author of the Fable of the Bees. In the second printing-office in which he worked, he laboured incessantly to convince his fellow workmen that a pint of porter does not contain half

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half so much nourishment as a penny roll, for which he obtained the ludicrous epithet of the *American aquatic*; yet he was finally enabled to make many converts to his doctrine;—a proof that he possessed strong persuasive powers, when we consider the deep-rooted attachment of those with whom he had to treat to their favourite libation.

After eighteen months residence in London, he returned to Philadelphia in the year 1726, and became clerk to a Mr Denham, a man of respectability, who had opened a warehouse in that city. He soon became acquainted with the principles of commerce, and led a very happy life in this new situation, till the connection was dissolved by the death of Mr Denham, which happened the following year. This again obliged him to become journeyman printer, and he was afterwards overseer in the office of Keimer, whom we have already mentioned. Here he acquired great esteem, and at length conceived the idea of setting up for himself, which he accomplished by entering into partnership with one Meredith, a fellow workman, whose father was in circumstances to enable him to advance them some money. His industry was habitual, but the idea that he was now working for himself, gave it additional energy. He was chiefly instrumental in the institution of a club which went by the name of the *junto*, and which was highly conducive to the intellectual improvement of its members. Before the admission of a candidate, the following questions were put to him. "Do you sincerely declare that you love mankind in general, of what profession or religion soever? Do you think any person ought to be harmed in his body, name, or goods, for mere speculative opinions, or his external way of worship? Do you love truth for truth's sake; and will you endeavour impartially to find and receive it yourself, and communicate it to others?" Franklin and his copartner began a newspaper, which the labours and talents of the former brought into repute, and by them the votes and laws of the assembly came afterwards to be printed. The partnership being dissolved by the departure of Meredith, Franklin, by the generous aid of friends, was enabled to take the whole business upon himself, to which he added the business of a stationer. When the increase of paper money engaged the attention of the American government, Franklin wrote an anonymous pamphlet in defence of the measure, by which he acquired considerable reputation, the countenance of men in power, and it placed his prosperity on a permanent basis. About this time he kept up a criminal correspondence with different females, chiefly owing, perhaps, to the disappointment he met with in the first object of his love, Miss Read, who by this time was married to another in consequence of his neglect. But we forget the faults of the man in the ingenuous confession of the penitent. A report prevailing that Miss Read's husband was married to another woman, he retired to the West Indies, where he died, and Franklin married the object of his first love in the month of September 1736, being then about 24 years of age. She proved a valuable wife, and in every sense of the word, an "help meet for him."

To him we are to ascribe the establishment of a public library at Philadelphia, which he accomplished in the year 1731, and had the satisfaction of seeing it arrive at that flourishing condition which it has long since attained. His "Poor Richard's Almanac," was begun in 1732, and became remarkable for the many prudential maxims with which it abounded; and the proverbial manner in which they were expressed made them take fast hold of the memory. His political career commenced in 1736, when he was chosen clerk to the general assembly of Pennsylvania, to which he was re-elected for several years, and at last became a representative. In 1737, he was made postmaster of Philadelphia, and in the subsequent year he greatly improved the police of the city, by the formation of a fire-company, and afterwards an insurance-company against losses by fire. In the war with France, which broke out in 1744, when the best means of defending the province against the inroads of the enemy, and when the militia bill was thrown aside from its being obnoxious to the people, Franklin suggested the idea of a voluntary association for their mutual defence, which was instantly signed by 1200 persons, and 10,000 subscriptions were obtained in a short time by circulating it through the province. By this and similar means America had an opportunity of ascertaining her own strength, and how to make use of it with advantage in cases of emergency.

About this time he began his interesting experiments on electricity, by the result of which he justly acquired a distinguished reputation. The library society of Philadelphia having received from Mr Peter Collinson in the year 1745, an account of the facts respecting electricity which at that time engrossed the attention of philosophers in Europe, Franklin set about studying the subject with the greatest assiduity. He gave the account of his researches, the title of "New experiments and observations on electricity, made at Philadelphia in America," and addressed to Mr Collinson in the form of letters, bearing date from 1747 to 1754. They were everywhere read with avidity, and universally admired; Dr Priestley speaks of them in the following terms. "It is not easy to say whether we are most pleased with the simplicity and perspicuity with which the author proposes every hypothesis of his own, or the noble frankness with which he relates his mistakes, when they were corrected by subsequent experiments." Not to swell this article with a detailed account of all his discoveries on this subject, we shall content ourselves with mentioning that most interesting of the whole, his grand discovery that lightning and electric fire are identically the same. This identity had begun to be suspected, and experiments had been made in France to ascertain the fact; but it was reserved to Franklin to demonstrate this fact by his own experiments. He obtained his first decisive proof of this in the month of June 1752, by setting up a silken kite into the air with a point of iron, and a key fastened to the end of the hempen string by which he held it. In this manner he drew down from a thunder cloud a sufficient quantity of electric fire to emit sensible sparks from the key. By means of an insulated iron rod which he fixed upon his house, he drew down the lightning, and was thus furnished with an opportunity of discovering whether it was positive or negative. As he firmly believed that philosophical discoveries were only valuable in so far as they could be productive of benefit to man, he made them subservient to the protection of buildings from the effects

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effects of lightning, which are truly alarming in North America. He applied physics to the purposes of common life, and in 1745 invented his Pennsylvania fireplaces, in which the qualities of an open grate were combined with that of a stove.

He turned his attention very much to the subject of politics, which was extremely natural for a man of a public spirit living under a popular government. He was chosen a representative of the city of Philadelphia for the provincial assembly in 1747. At this time a contest subsisted between the assembly and the proprietaries, as to the claim of the latter to be exempted from public burdens. Franklin took the popular side of the question, by which he acquired great influence, and was regarded as the head of the opposition. This was not the offspring of eloquence, for he seldom spoke, and never in the form of an harangue; but his pointed observations, his unadorned good sense, frequently destroyed the effect of the most elaborate orations.

He drew up the plan of an academy to be founded at Philadelphia, from a conviction that education in a free state is of the utmost importance. It was carried into effect in the year 1750, by virtue of a subscription, to which the proprietors afterwards liberally contributed. He discharged the duties of his office as postmaster of Philadelphia with so much punctuality, that he was appointed deputy postmaster general for the British colonies in 1753, and the revenue was soon bettered by his unwearied exertions. A plan for conciliating the Indians, and forming an alliance with them, was drawn up by Franklin in 1754, to which the commissioners at Albany agreed, and a copy of it was transmitted to the British privy council. It is a singular circumstance, that this plan was rejected by the assemblies as giving too much power to the crown, while the British ministry declared that it gave too much influence to the representatives of the people. In the year 1757, Franklin set sail for London, as agent for Pennsylvania, the assembly of that province being involved in disputes with the proprietary. It was agreed on by the privy council, that landholders should pay their share of the public burdens, on condition Franklin would engage that they should be fairly proportioned. He continued at the British court as agent for his province, and acquired so great reputation, that the same trust was reposed in him for Massachusets, Maryland, and Georgia. His merit as a philosopher was now justly appreciated in Europe, and he was made a fellow of the Royal Society of London. The degree of L. L. D. was also conferred upon him at St Andrew's, Edinburgh, and Oxford.

In the year 1762 he returned to America, where he received the thanks of the assembly of Pennsylvania, and a handsome recompense in money for his important services. When the stamp act occasioned so much disturbance in America, Dr Franklin was summoned to the bar of the house of commons, to give evidence respecting the dispositions of the people, whether he thought they could be induced to submit to it; and the energy and clearness of his representations were instrumental in procuring the repeal of that obnoxious measure.

On the commencement of hostilities between Great Britain and the colonies in 1775, he returned to America, and was chosen a delegate to congress by the legislature of Pennsylvania. In 1776 he treated with Lord Howe on the subject of a reconciliation, and in one of his letters expressed in strong terms the temper of the British nation, to which he imputed the fatal extremity then arrived. When the question of independence came to be discussed, he was decidedly in favour of the measure, and was highly instrumental in bringing over the public mind to the same opinion. When a negotiation with France was opened, Dr Franklin was chosen one of the personages to reside at that court. His political abilities eminently qualified him for such a station, and his character as a philosopher gained him great esteem in a country where knowledge is revered. He brought about a treaty with France of an offensive and defensive nature in 1778, the immediate consequence of which was a war with Britain. He was one of those who signed the provisional treaty the year following. Prior to his leaving Europe he concluded a treaty with Sweden and Prussia. He was recalled from that active station in 1785, which he had filled with so much ability, and chosen president of the supreme executive council. He was chosen president of a society for alleviating the miseries of prisons, and abolishing slavery. His increasing infirmities made him withdraw from all public business in 1788; and on April the 17th 1790, he terminated his active and useful life, in the 85th year of his age.

Perhaps no man ever exceeded Dr Franklin in that solid practical wisdom which consists in pursuing valuable ends by the most appropriate means. His cool temper and sound judgment secured him from erroneous expectations. He saw things in their true light, and predicted consequences with nearly a prophetic spirit. He said of himself "I have always set a greater value on the character of a *doer of good*, than any other kind of reputation." In 1779, his "Political, Miscellaneous, and Philosophical pieces," were published in 4to and 8vo. His essays, humorous, moral, and literary, were published after his death, in two small volumes.

He was by no means inattentive to his own interest, of which his rapid advancement in life furnishes an ample proof; yet he never neglected the interest of society, or the good of mankind in general. The delicate situations in which he frequently stood, unavoidably exposed him to the censure of his enemies; yet his general conduct has long ago received the approbation of his countrymen, by whom he was considered as the best and most valuable of citizens. When we view him as a philosopher, we must ascribe his chief merit to his electrical discoveries, yet on many other topics, such as meteorology and mechanics, he evinced himself a man of considerable penetration. As a political writer, his great merit is clearness, energy, and simplicity; and as a miscellaneous author he possesses a fund of humour which cannot fail to be at once both entertaining and impressive.

Franklin, the name of several counties in America, such as Franklin county in Pennsylvania, computed to contain 800 square miles, or 512,000 acres. It contains 11 townships, and 15,655 inhabitants. Franklin, a county in Kentucky; the name of one in Halifax, of one in Virginia, and of another in Georgia, which contains 1041 inhabitants, including 156 slaves. It is also the name of a township in Massachusets; of one in Pennsylvania, another in New York, and of another in Connecticut,

Connecticut, as well as of a small isle at the mouth of St George's river.

FRANKS, FRANCS, FRANKIS, or FRANQUIS, a name which the Turks, Arabs, Greeks, &c. give to all the people of the western parts of Europe. The appellation is commonly supposed to have had its rise in Asia, at the time of the croisades; when the French made the most considerable figure among the croissees: from which time the Turks, Saracens, Greeks, Abyssinians, &c. used it as a common term for all the Christians of Europe; and called Europe itself *Frankistan*. The Arabs and Mahometans, says M. d'Herbelot, apply the term *Franks* not only to the French (to whom the name originally belonged), but also to the Latins and Europeans in general.

But F. Goar, in his notes on Condinus, cap. 5. n. 43. furnishes another origin of the appellation *Franks*, of greater antiquity than the former. He observes, that the Greeks at first confined the name to the *Franci*, i. e. the German nations, who had settled themselves in France or Gaul; but afterwards they gave the same name to the Apulians and Calabrians, after they had been conquered by the Normans; and at length the name was farther extended to all the Latins.

In this sense is the word used by several Greek writers; as Comnenus, &c. who to distinguish the French, call them the *western Franks*. Du Cange adds, that about the time of Charlemagne they distinguished eastern France, western France, Latin or Roman France, and German France, which was the ancient France, afterwards called *Franconia*.

FRASCATI, or FRESCATI. See FRESCATI.

FRASERSBURGH, a small sea-port town in the county of Aberdeen, situated on the point of land called *Kinnaird's Head*, which is the southern extremity of the Murray frith. It has a small but excellent harbour, made and kept up at a considerable expence by the proprietor and the town, and well adapted for building small vessels. According to the tide, there are from 11 to 15 feet water within the harbour, and 20 feet immediately without at spring tides: without is a tolerable road for shipping, in a bay nearly a league in length and half a league in breadth, with good anchorage in a sandy bottom. Vessels of about 200 tons burden can enter the harbour. Frasersburgh contained 2271 inhabitants in 1811, and is well situated for trade with the east coast of Europe. The only manufacture carried on in Frasersburgh is in linen yarn, of which there is annually exported to the amount of 3000l. or 4000l.

FRATERNAL, something belonging to the relation of brother.

FRATERNAL Affection is the love and attachment subsisting among, or due to one another by, children of the same family.

Though all mankind sprung from the same head, are bound to cultivate a mutual good will to each other; yet this duty is not so obvious and striking as that which is incumbent on those who belong to the same family. Nothing can approach nearer to self love than fraternal affection: and there is but a short remove from our own concerns and happiness, to theirs who come from the same stock, and are partakers of the same blood. Nothing, therefore, can be more horrible than discord and animosity among members so allied; and nothing so beautiful as harmony and love.

This relation is formed by nature, not by choice; and though it has many things in common with, yet it is prior to, the obligations of friendship: consequently nature and reason dictate that there should be a peculiar affection between brethren. We are not obliged, however, to make a brother or sister an intimate or bosom friend in preference to one who is not akin. Diversity of temper, and want of suitable qualifications, may render it unsafe and improper. But where friendship and fraternity meet in the same persons, such a conjunction adds a lustre to the relation.

Among brethren, a hearty benevolence, an ardent concern for each others welfare, a readiness to serve and promote it, are the peculiar offices of this relation; and though friends are to have their share, yet the claim of kindred is first and ordinarily strongest. "Necessaria præsidia vitæ debentur iis maxime (says Cicero), quos ante dixi, (i. e. propinquis): vita autem, victusque communis, concilia, sermones, &c. in amicitiis vigent maxime," *De Officiis*.

FRATERNITY, BROTHERHOOD, the relation or union of brothers, friends, partners, associates, &c.

FRATERNITY, in a civil sense, is used for a guild, association, or society of persons, united into a body, for some common interest or advantage. See COMPANY and GUILD.

FRATERNITY, in the Roman Catholic countries, signifies a society for the improvement of devotion. Of these there are several sorts; as, 1. The fraternity of the rosary, founded by St Dominic. It is divided into two branches, called the *common rosary*, and the *perpetual rosary*; the former of whom are obliged to confess and communicate every first Sunday in the month, and the latter to repeat the rosary continually. 2. The fraternity of the scapulary, whom the blessed Virgin, according to the sabbatine bull of Pope John XXII. has promised to deliver out of hell the first Sunday after their death. 3. The fraternity of St Francis's girdle, are clothed with a sack of a gray colour, which they tie with a cord, and in processions walk barefooted, carrying in their hands a wooden cross.—4. That of St Austin's leathern girdle comprehends a great many devotees. Italy, Spain, and Portugal, are the countries where one sees the greatest number of these fraternities, some of which assume the name of *arch-fraternities*. Pope Clement VII. instituted the arch-fraternity of charity, which distributes bread every Sunday among the poor, and gives portions to 40 poor girls on the feast of St Jerome their patron. The fraternity of death buries such dead as are abandoned by their relations, and causes masses to be celebrated for them.

FRATRES ARVALES. See ARVALES.

FRATRIAGE, the partition among brothers, or coheirs, coming to the same inheritance or succession.

FRATRICELLI, in ecclesiastical history, an enthusiastic sect of Franciscans, which rose in Italy, and particularly in the marquisate of Ancona, about the year 1294. The word is an Italian diminutive, signifying *fraterculi*, or "little brothers;" and was here used as a term of derision, as they were most of them apostate monks, whom the Italians call *fratelli*, or *fratricelli*. For this reason the term *fratricelli*, as a nickname, was given to many other sects, as the Catharists, the Waldenses, &c. however different in their opinions and in their conduct. But this denomination applied to

Fratricelli, Fratricide. the austere part of the Franciscans was considered as honourable. See FRANCISCANS.

The founders were P. Maurato, and P. de Fossombroni, who having obtained of Pope Celestin V. a permission to live in solitude, after the manner of hermits, and to observe the rule of St Francis in all its rigour, several idle vagabond monks joined them, who, living after their own fancies, and making all perfection to consist in poverty, were soon condemned by Pope Boniface VIII. and his successor, and the inquisitors ordered to proceed against them as heretics: which commission they executed with their usual barbarity. Upon this, retiring into Sicily, Peter John Oliva de Serignan had no sooner published his Comment on the Apocalypse, than they adopted his errors. They foretold the reformation of the church, and the restoration of the true gospel of Christ, by the genuine followers of St Francis, and declared their assent to almost all the doctrines which were published under the name of the abbot Joachim, in the "Introduction to the everlasting Gospel," a book published in 1520, and explained by one of the spiritual friars whose name was Gerhard. Among other enormities inculcated in this book, it is pretended that St Francis was the angel mentioned in Rev. xiv. 6. and had promulgated to the world the true and everlasting Gospel of God; that the Gospel of Christ was to be abrogated in 1620, and to give place to this new and everlasting Gospel, which was to be substituted in its room; and that the ministers of this great reformation were to be humble and bare-footed friars, destitute of all worldly employments. Some say they even elected a pope of their church; at least they appointed a general, with superiors, and built monasteries, &c. Besides the opinions of Oliva, they held, that the sacraments of the church were invalid; because those who administered them had no longer any power or jurisdiction. They were condemned afresh by Pope John XXII. in consequence of whose cruelty they regarded him as the true antichrist; but several of them returning into Germany, were sheltered by Lewis, duke of Bavaria, the emperor.

There are authentic records, from which it appears that no less than 2000 persons were burnt by the inquisition, from the year 1318 to the time of Innocent VI. for their inflexible attachment to the poverty of St Francis. The severities against them were again revived towards the close of the 15th century by Pope Nicolas V. and his successors. However, all the persecutions which this sect endured were not sufficient to extinguish it; for it subsisted until the times of the reformation in Germany, when its remaining votaries adopted the cause and embraced the doctrine and discipline of Luther. And this has led popish writers to charge the Fratricelli with many enormities, some of which are accounted by M. Bayle, art. *Fratricelli.*

The Fratricelli had divers other denominations: they were called *fratricelli*, according to some, because they lived in community, in imitation of the primitive Christians, or rather through the humility of the founder of the Franciscan order, to which the Fratricelli originally belonged; *Dulcini*, from one of their doctors; *Bizochi*, *Beguins*, and *Beghardi.*

FRATRICIDE, the crime of murdering one's brother. See PARRICIDE.

FRAUD, in *Law*, signifies deceit in grants or conveyances of lands, &c. or in bargains and sales of goods, &c. to the damage of another person.

A fraudulent conveyance of lands or goods to deceive creditors, as to creditors is void in law. And a fraudulent conveyance in order to defraud purchasers, is also to such purchasers void; and the persons justifying or putting off such grants as good, shall forfeit a year's value of the lands, and the full value of the goods and chattels, and likewise shall be imprisoned. See CHEATING.

FRAUSTADT, a town of Silesia, on the frontiers of Poland, remarkable for a battle gained by the Swedes over the Saxons in 1706. It is 70 miles N. N. W. of Breslau. E. Long. 15. 50. N. Lat. 51. 45.

FRAXINELLA. See DICTAMNUS, BOTANY *Index.* —It is remarkable of this odorous plant, that, when in full blossom, the air which surrounds it in a still night may be inflamed by the approach of a lighted candle. Dr Watson doubts whether this inflammability proceeds from an inflammable air which is exhaled by the plant, or from some of the finer parts of the essential oil of the plant being dissolved in the common atmospherical air. The latter is the most probable supposition; for were it the pure inflammable air, as Mr Cavallo observes, it would, on account of its small specific gravity, leave the plant as soon as it was produced. Common air acquires the property of becoming inflammable, by being transmitted through several essential oils.

FRAXINUS, the ASH; a genus of plants belonging to the polygamia class; and in the natural method ranking under the 44th order, *Sepiariæ.* See BOTANY *Index.*

FRAY literally signifies to fret; as cloth or stuff does by rubbing, or over much wearing.

Among hunters a deer is said to fray his head, when he rubs it against a tree, to cause the skins of his new horns to come off.

FREA, or FRIGGA, the wife of Odin, was, next to him, the most revered divinity among the Heathen Saxons, Danes, and other northern nations. As Odin was believed to be the father, Frea was esteemed the mother of all the other gods. In the most ancient times, Frea was the same with the goddess Herthus, or Earth, who was so devoutly worshipped by the Angli and other German nations. But when Odin, the conqueror of the north, usurped the honours due only to the true Odin, his wife Frea usurped those which had been formerly paid to mother Earth. She was worshipped as the goddess of love and pleasure, who bestowed on her votaries a variety of delights, particularly happy marriages and easy childbirths. To Frea the sixth day of the week was consecrated, which still bears her name.

FREAM, a name given by farmers to ploughed land worn out of heart, and laid fallow till it recover.

FREATS, or FREITS, a term used in Scotland for *ill omens*, and sometimes denoting accidents supernaturally unlucky. King James VI. in his *Dæmonologie, MS. pen. Edit.* B. I. ch. iv. p. 13. "But I pray you forget not likewise to tell what are the Devill's rudiments? E. His rudiments I call first in general all that quhilk is called vulgairelie the virtu of woode, herbe, Freits. Frederick.

herbe, and staine; quhilk is used by unlawful charmis without natural causis. As lykeways all kynd of prattiques, *freitis, or other lyk extraordinair actions, quilk cannot abyde the trew twiche of naturall raison.*" It occurs again in the same sense in p. 14. *marg. note;* and in p. 51. speaking of *Sorcerers*, "And in generall that naime was gevin thaime for using of sic chairmis and *freitis*, as that craft teachis thaime."

FRECKLES, Lentigines, spots of a yellowish colour, of the bigness of a lentile seed, scattered over the face, neck, and hands. Freckles are either natural, or proceeding accidentally from the jaundice or the action of the sun upon the part. Heat or a sudden change of the weather, will often cause the skin to appear of a darker colour than natural; and thereby produce what is called *tan, sunburn*, and *morphew*, which seem to differ only in degree; and usually disappear in winter.

Persons of a fine complexion, and whose hair is red, are the most subject to freckles, especially in those parts which they expose to the air.

To remove freckles, put juice of lemons in a glass phial, and mixing it with sugar and borax finely powdered, let it digest eight days, and then use it. Homberg proposes bullocks gall mixed with alum, and, after the alum has precipitated, exposed three or four months to the sun in a close phial, as one of the best remedies known for the removing of freckles.

FREDBERG. See Freyberg.

FREDERICA, a town of North America, in Georgia, seated at the mouth of the river Alatamaha. It was founded by General Oglethorpe. The island it stands upon is called *St Simons's;* and is about 13 miles in length, and 4 in breadth. W. Long. 81. 25. N. Lat. 31. 13.

FREDERICK II. the Great, of Prussia, one of the greatest warriors of the age in which he lived, was the son of Frederick-William then hereditary prince of Brandenburg, and Maria Dorothea a princess of the house of Brunswick. He was born in 1712, the year before his father Frederick I. mounted the throne of Prussia. The latter was so far from being a patron of literature, that he regarded nothing but what related to the military art; and most of his generals, whatever their merits in their own line might be, scarce knew how to sign their names. So great indeed was the ignorance of the monarch himself, that he banished from his dominions a philosopher of the name of *Wolf*, merely because he maintained the doctrine of pre-established harmony; upon which a theologian named *Lange* asserted, that on such principles his majesty's grenadiers were not culpable when they deserted, it being only the necessary consequence of the impulse their machine had received from their Creator. His son was of a disposition the very reverse of his father. Being put from his birth under the care of Val de Recoule a French lady of great merit and understanding, he acquired, in his early years, not only a taste for literature in general, but a predilection for the French language, which was not obliterated throughout his whole life.

It is not to be supposed that a prince of the disposition above mentioned, would suffer his son to be long engaged in literary pursuits. At seven years of age, young Frederick was taken out of the hands of Madame de Recoule, and put under the care of military tutors. General count de Finkestein, an old warrior, was appointed his governor; his sub-governor was Colonel de Kalkstein, an officer renowned for his courage and experience; he was taught mathematics and fortification by Major Senning; Han de Jendun, a Frenchman, instructed him in other branches of knowledge; and a cadet of the name of *Kenzel*, taught him his exercise. At eight years of age he was furnished with a small arsenal stored with all sorts of arms proportioned to his age and strength, of which his father left him absolute master. In a short time he was named captain and chief of the corps of cadets; and the young prince performed every day, in miniature, with his little soldiers, all the evolutions with which his father exercised his giants. At last he received the command of a company in his father's regiment, famous throughout all Europe, and which was composed of men of whom scarce one was short of seven French feet.

Born, however, with a taste for the arts, he devoted to their cultivation every moment he could escape from the vigilance of his guardians. He was more particularly fond of poetry and music, and when he could find a moment's leisure, he read French authors, or played on the flute; but his father as often as he surprised him playing or reading, broke his flute and threw his books into the fire. The prince, chagrined at such injurious treatment, and having a great desire to visit Germany, England, France, and Italy, desired permission to travel. This, however, his father would not allow, but permitted him to accompany himself in the little journeys he made from time to time into Germany; and, in 1728, took him to Dresden to see the king of Poland. By these little expeditions the desire of the prince to visit other countries was only the more inflamed, so that at last he formed a design of setting out without his father's knowledge. The design was intrusted to two of the prince's young friends, named *Kat* and *Keit;* money was borrowed for the occasion, and the day of their departure fixed, when unluckily the whole project was discovered. The old king, implacable in his resentment, and considering his son as a deserter, determined to put him to death. He was shut up in the fortress of Custrin; and it was with the utmost difficulty that the count de Seckendorf, sent for the purpose by the emperor Charles VI. was able to alter the king's resolution. Certain vengeance, however, was determined on both the intended associates in Frederick's journey. Keit escaped the danger by flying into Holland; but Kat had not that good fortune. The king first directed that he should be tried by a court martial; but as they, contrary to his expectation, only sentenced the criminal to perpetual imprisonment, the revengeful monarch by an unheard-of exercise of the royal prerogative, caused him to be beheaded. The execution was performed under the windows of the prince royal, whose head was held towards the scaffold by four grenadiers: but no sooner did he approach the window, and see his friend in the hands of the executioner, than he stretched out his arms towards him, crying out, "Kat! Kat!" and instantly fainted away. During the remainder of his life he considered capital punishments with a great degree of horror, and they were rare throughout the Prussian dominions while he continued to reign. When the emperor had succeeded in preventing the execution of Frederick, the king remarked, that

Frederick. "Austria would one day see what a serpent she had nourished in her bosom." The royal prisoner remained a year at Custrin; during which time his father wished that he should learn the maxims of government and finance. For this purpose, M. de Munchow, president of the chamber of domains and finances, was ordered to make him assist at all their assemblies, to consider him as a simple counsellor, to treat him as such, and make him work like others. The young counsellor, however, though he assisted at their meetings, did not trouble himself with reading acts or copying decrees. Instead of this, he amused himself sometimes with reading French pamphlets, and at others with drawing caricatures of the president or members of the assembly. M. Munchow himself was likewise very favourable to the prince at this time, by furnishing him with books and other articles of amusement, notwithstanding the express prohibition of his father; though in this he certainly ran great risk; for the old king, who set but a very light value on human life, would undoubtedly have put him to death had he received intelligence of his complaisance.

Frederick, after passing the time above mentioned in confinement, was recalled to Berlin, on pretence of being present at the celebration of his eldest sister's marriage with the hereditary prince of Bareith; but the trne reason was, that the king had now prepared a match for the prince himself. This was the princess Elizabeth Christina of Brunswick, niece to the empress. Frederick, who was not only totally indifferent to the fair sex in general, but particularly prejudiced against this princess, made some objections; his father, however, overcame all obstacles with "his usual arguments (says the author of the life of Frederick), viz. his cane, and a few kicks."

The coldness which Frederick at this time showed for the fair sex appears not to have been natural; for as early as the year 1723, though then only in the 11th year of his age, he is said to have fallen in love with the princess Anne, daughter of George II. Even at this early period he entered into vows to refuse every other but her for his consort; nor were these ever broken, as far as depended on himself. The marriage perhaps would have taken place, had it not been for some differences which arose between the courts of Prussia and Hanover about a few acres of meadow land, and two or three Hanoverians inlisted by the Prussian recruiters. It is supposed also, that it was intended at one time to marry him to Maria Theresa of Austria; but, as in that case it would have been necessary to change his religion, Frederick derived from thence a plausible pretence for refusing the match. The princess whom he espoused had a large share of beauty; and, what was still better, an excellent heart: but Frederick is said to have suffered so much in his former amours, that certain natural and unsurmountable impediments remained to the completing of his marriage with any woman. Scarcely therefore was he in bed with his young spouse, when a cry of *Fire!* was raised by his friends. Frederick got up to see where the conflagration was: but finding it to be a false alarm, he sent messengers to compose the princess; but neither that night, nor any other, did he think proper to disturb her rest.

On occasion of this marriage, Frederick received from his father the county of Rupin. He resided in the capital of this county, named also *Rupin*, for some time; but afterwards chose Rheinsberg for his place of abode. This is a little town built in the sands, on the confines of Mecklenburg, and at that time containing only 1000 inhabitants; but it was soon greatly improved by Frederick. Having put over the great gate of the castle, however, the following inscription, FREDERICO TRANQUILLITATEM COLENTI, his father was displeased with it, and therefore hurried him from his peaceful retreat into the noise and tumult of war. At this time the succession to the crown of Poland had kindled a general war throughout Europe, and the king of Prussia was to send 10,000 auxiliaries to the Imperial army, then commanded by Prince Eugene. The king conducted his troops in person, and resolved to take this opportunity of giving his son an idea of war. At this time, however, he learnt but little; and only saw, as he himself expresses it, the shadow of the great Eugene. That consummate general, nevertheless, did not overlook his merit; but predicted that he would one day be a great captain. Frederick having gone to reconnoitre the lines at Philipsburg, in his return through a very open wood, was exposed to the cannon of the lines, which thundered incessantly. The balls broke a number of branches on every side of him: notwithstanding which, he never caused his horse to move quicker; nor did his hand which held the bridle ever alter its motion even for a moment. He continued to converse quietly with the generals who attended him, and never showed the smallest sign of apprehension. Being one night at supper with Field-Marshal Grumkow, the conversation turned on the young Prince Eugene who died on the Rhine; and he was asked whether that prince would ever have become a great man? Frederick decided in the negative, on account of young Eugene's not having known at any period of his life how to choose a friend who dared to tell him the truth.

During this campaign the health of the old king was so much impaired, that he was obliged to leave the army; and Frederick, on his return, was for some time intrusted with signing all the orders in his father's name. On the king's recovery the prince was sent to Stettin, under the care of the prince of Dessau, that he might see the fortifications of that town. He was afterwards permitted to go to Konigsberg to see the unfortunate Stanislaus, who had taken refuge in that place, and who was no less remarkable for his philosophy and constancy than for his misfortunes. With him Frederick remained for some weeks, and contracted a friendship which was not dissolved but by the death of Stanislaus. At last he was allowed to return to his peaceful mansion at Rheinsberg, where he remained till the death of his father. In this place his time was occupied alternately by the study of the sciences, the cultivation of the arts, and the pleasures of friendship. Philosophy, history, politics, the military art, poetry, and music, agreeably succeeded each other, and had each its stated period. The prince passed the greatest part of the day in his library; and the remainder in the society of a select company of agreeable and learned men. The principal of these were Chasot, a French officer; Kayserling, a gentleman of Courland, on whom the prince bestowed the name of *Cæsarion;* Jordan, a French refugee; and Knobelsdorf, director of the buildings and gardens; but who could converse on all the arts of designing with great taste and judgment.—In these meetings, gaiety generally presided; there were generals to speak of war, musicians to form concerts, and excellent painters to decorate the apartments. Whilst Knobelsdorf was executing landscapes and laying out the gardens, Pesne was immortalizing himself by his ceilings, and Du Buisson by his pictures of flowers. The two Grauns composed excellent music, or directed the orchestra; and Benda, one of the first violins of Europe, accompanied the prince, who played extremely well on the flute. The morning was usually dedicated to study; gaiety and agreeable conversation prevailed at every repast; and every evening there was a little concert.—In this retreat Frederick conceived that ardent passion for military glory, and the aggrandizement of his kingdom, for which he became at last so remarkable; and here he is supposed to have formed the most sublime and daring projects. He was fired with a desire of imitating the celebrated heroes of antiquity, of whom he read in the ancient authors, and for which he set apart some hours every day. Amongst the works which he read almost every year were Herodotus, Thucydides, Xenophon, Plutarch, Tacitus, Sallust, Livy, Quintus Curtius, Cornelius Nepos, Valerius Maximus, Polybius, Cæsar, Vegetius, &c. He never spoke but with enthusiasm of the great warriors of Greece and Rome; and when seated on the throne thought he could never distinguish an able soldier in a more honourable manner than by conferring on him a Roman sirname. Hence he distinguished by the name of *Quintus Icilius* M. Guichard, who had written some treatises on the military art of the ancients; giving him at the same time a free battalion. This name of *Quintus Icilius* was retained by M. Guichard as long as he lived.

In his pursuit of glory Frederick found that it was not improper to cultivate the friendship of celebrated poets, philosophers, and others of the literary class; for which purpose he flattered, commended, and complimented all the most celebrated literati of Europe at that time. "The philosophers (says the author of his life) answered him as a mad lover writes to his mistress. They wrote to him that he was a great poet, a great philosopher, the *Solomon* of the north. All these hyperboles were printed; and Solomon was not sorry for it, though he had too much understanding to believe in them. Wolf, Rollin, Gravesande, Maupertuis, Algarotti, Voltaire, were honoured with his correspondence. The last especially, accustomed to offer up incense to the idol of the day, were it transported from the dunghill to the altar, did not fail to exalt as the first man of the universe a prince who was in expectancy of the throne, and who assured him that he was the greatest philosopher of the age and the first poet in the world."

That Frederick might keep up his character with the literati, or perhaps from a real predilection for his principles, he patronized the Apology of Wolf, and had his principal treatises translated into French. He even prevailed upon his father to relax a little in favour of that philosopher. A commission of reformed and Lutheran theologians was appointed in 1736, to examine into the tenets of that unfortunate philosopher. Wolf was declared innocent, and a letter was sent to him at Marpourg containing an invitation to return; but the philosopher did not think proper to make his appearance till the year 1740, when his protector was seated on the throne.

During his residence at Rheinsberg, Frederick composed his refutation of the principles of Machiavel, under the title of *Anti-Machiavel:* of which he sent the manuscript to Voltaire to correct, and to get printed.

The old king, now almost worn out with infirmity, saw with regret the predilection his son entertained for men of letters; and, in his peevish fits, often threatened the whole society with confinement in the fortress of Spandau. These threats frequently occasioned a violent alarm among the joyous company at Rheinsberg, which it required all the eloquence of Frederick to quiet. Their apprehensions on this account, however, were soon removed. At the commencement of the year 1740, the king's disorder increased to a great degree, and in the month of May his case became desperate. He lived, however, till the 31st of that month, when he expired, and left the throne to his son Frederick II.

The acquisition of a kingdom did not abate Frederick's passion for literature, though to this he was now obliged to superadd the qualities and labours of a great king. A consideration of his transactions in this character falls under the article PRUSSIA, to which we refer: these, indeed, so totally engrossed the remaining part of his life, that little more remains to be said under this article, than to relate some anecdotes by which we may be in some measure able to trace the character of this great and singular personage.

It has already been mentioned, that in the early part of his life, Frederick had conceived a great inclination to travel. This passion seems not to have been extinguished by the splendour of his new situation; for having, soon after his accession, gone into Prussia and Westphalia to receive the homage of the inhabitants, he formed a resolution of proceeding *incognita* as far as Paris. Being discovered at Strasbourg, however, he laid aside the design of proceeding to Paris, and went to see his states in Lower Germany. Here he wrote the celebrated Voltaire, that he should come *incognito* to visit him at Brussels; but being seized with an indisposition in the little palace of Meuse, two leagues from Cleves, he wrote again to that philosopher, informing him that he expected he should make the first advances. The following curious account is given by him of his reception, &c. "The only guard I found at the gate was one soldier. The privy counsellor, Bambonet, was cooling his heels in the court: he had large ruffles of dirty linen; a hat full of holes; and an old magisterial peruke, one end of which descended as low as his pockets, and the other scarcely reached his shoulder. I was conducted into his majesty's apartment, where there was nothing but bare walls. I perceived in a cabinet, by the glimmering of a taper, a truckle bed, two feet and a half wide, on which lay a little man muffled up in a night gown of coarse blue cloth. This was the king, in a strong perspiration, and even trembling, under a wretched blanket, in a violent fit of the ague. I bowed to him; and began by feeling his pulse, as if I had been his first physician. The fit over, he dressed himself and sat down to table. Algarotti, Kayserling, Maupertuis, the king's minister to the States General, and myself, were of the party; where we

Frederick. we conversed profoundly on the immortality of the soul, on liberty, and the androgynes of Plato."

This rigid economy, and contempt of every luxury with regard to his own person, was maintained by Frederick as long as he lived. The following account, taken likewise from Voltaire, will give an idea of his manner of living. "He rose at five in the morning in summer, and six in winter. A lacquey came to light his fire, and dress and shave him; and indeed he almost wholly dressed himself. His room was not inelegant. A rich ballustrade of silver, ornamented with little cupids, seemed to enclose an alcove bed, the curtains of which were visible; but behind them, instead of a bed, there was a library: the king slept on a truckle bed with a slight mattress concealed behind a screen. Marcus Aurelius and Julian, those apostles of Stoicism, did not sleep in a more homely manner. At seven his prime minister arrived with a great bundle of papers under his arm. This prime minister was no other than a clerk who had formerly been a soldier and valet-de-chambre. To him the secretaries sent all their dispatches, and he brought extracts of them, to which the king wrote answers in two words on the margin: and thus the affairs of the whole kingdom were expedited in an honr. Towards eleven the king put on his boots, reviewed his regiment of guards in the garden, and at the same hour the colonels were following his example in their respective provinces. The princes his brothers, their general officers, and one or two chamberlains, dined at his table; which was as good as it could be in a country where there is neither game, tolerable butchers meat, nor a pullet, and where the very wheat is brought from Magdebourg. After the repast, he retired alone into his cabinet, where he made verses till five or six o'clock. Then came a young man named D'Arget, formerly secretary to Valory the French envoy, who read to him. A little concert began at seven, in which the king played on the flute with as much skill as the first performer; and pieces of his composition were frequently executed. Supper was served in a little hall, the singular and striking ornament of which was a picture, the design of which he had given to Pesne, one of our best colourists. It was a fine picture of Priapus. These repasts were not in general the less philosophic on that account. Never did men converse in any part of the world with so much liberty respecting all the superstitions of mankind, and never were they treated with more pleasantry and contempt. God was respected; but none of those who had deceived men in his name were spared. Neither women nor priests ever entered the palace. In a word, Frederick lived without a court, without counsel, and without religious worship."

As Frederick had espoused his princess entirely contrary to his inclination, it was imagined that on his accession to the throne he would embrace the opportunity of setting himself free from engagements so disagreeable to himself. The queen was not without suspicions of this kind, insomuch that she was on the point of fainting away when he made his first visit to her. To the surprise of all parties, however, he made her a very affectionate speech, apologizing for his indifference, and inviting her to participate with him the throne of which she was so worthy. In the first year of his reign he restored the academy of sciences at Berlin which had been founded in 1700; but he soon became disgusted with its members, whom he endeavoured at all times to ridicule rather than encourage. His war with the queen of Hungary, however, which took place almost immediately after his accession, for some time prevented him from taking such an active part in literary matters as he was naturally inclined to do. After the peace, being at liberty to follow his inclination, he gave full scope to his passion for literature; and in the interval betwixt the conclusion of the first war and beginning of that of 1756, he composed most of the works which are now ascribed to him. At this time he wrote his *History of my own Times*, afterwards announced among his posthumous works. In writing history he acquired a taste for historians; and justly gave the preference to the ancients, the most celebrated of whose works he perused every year. Voltaire was his principal literary correspondent, whom he invited to reside with him. Afraid of losing his liberty, however, that philosopher hesitated, excused himself, and entered into pecuniary treaties, first for himself, and afterwards for his niece Madame Dennis, whom he wished to accompany him. At last he was determined by seeing a poem from Frederick to M. d'Arnaud, in which the latter was compared to the rising, and Voltaire to the setting sun. By this Voltaire was so much piqued, that he set out for Berlin without delay, and arrived there in June 1750. He was received in the most magnificent and affectionate manner, and for some time his situation was very agreeable; but the disputes and rivalship which took place betwixt him and Maupertuis soon threw every thing into confusion. In these the king interfered in such a manner as was certainly below his dignity; and he often exercised himself in making a jest of the other men of letters in a way exceedingly disgusting, and which induced many of them to leave him. The squabbles with Voltaire were sometimes very diverting; an account of some of which is given under the article VOLTAIRE. They ended at last in a final quarrel with that wit, and his departure from the kingdom. The restless disposition of Frederick showed itself after his departure, by his attempts to provoke the literati who remained at his court to quarrel with him as Voltaire had been accustomed to do. But they were of too passive a disposition to gratify him in this respect, choosing rather to suffer the most mortifying strokes of raillery, or to leave the kingdom altogether, than to contend with him. This proved so uneasy to the king, that he one day exclaimed, "Shall we have no more quarrels then?" The breaking out of the war in 1756, however, put a stop to his diversion, and afforded him as many enemies as he could wish. The exploits he performed during the seven years which this unequal contest lasted, are almost incredible *; and it is amazing how the fortitude and resolution of any person could enable him to sustain the difficulties which during this period he had to encounter. In one fatal moment, indeed, even the resolution of Frederick was on the point of giving way. This happened after the battle of Colin, when his affairs seemed altogether desperate, before they were retrieved by the victory at Rosbach. At this time he wrote to his sister at Bareith, that he was on the point of putting an end to his own life; but as this resolution did not extinguish in him the love of glory, he wished

* See Prussia.

Frederick. wished to have it said that he made verses on the brink of the grave. With this view he wrote a long poetical epistle to the marquis d'Argens, in which he communicated to him his design, and bade him farewell.

Happily, at last, the king's affairs took a better turn, and such desperate thoughts were laid aside. His constitution, however, was irreparably injured by the excessive fatigues he had sustained. Soon after the conclusion of the peace, his body began to bend, and his head to incline to the right side: by degrees he became very infirm; he was tormented with the gout, and subject to frequent indigestions. All his distempers, however, were born with invincible patience; and, till a very short time before his death, he never ceased to attend his reviews, or visit the different provinces of his dominions. He has been known to review his troops, and gallop through all the ranks as if he felt no pain, notwithstanding that an abscess which had broken out upon him, and approached to a suppuration, frequently, upon such occasions, touched the saddle. In August 1785 he impaired his health still farther by assisting at a review, where he was exposed without even a cloak to a heavy rain for four or five hours. On his return to Potzdam he was seized with a fever; and, for the first time, became unable to assist at the military exercises of Potzdam, which take place in September. His malady, however, did not prevent him from dictating the disposition of these exercises during the three days they lasted, and he always gave the word in presence of his generals and the foreigners of distinction then at Potzdam. About the end of autumn the fever left him, but was succeeded by a violent cough; and he continued free from the gout which had usually attacked him at this season. He was greatly weakened by the cough, which prevented him from sleeping; but this did not in the least interrupt him in the execution of business. Every morning at four or five o'clock, he ordered the three cabinet secretaries to enter his apartment, where he dictated answers to their papers. It was not till after the dispatch of all his affairs that he saw a surgeon or sometimes a physician, though he had a bad opinion of the physicians in general, whom he consulted on his distemper. In the evening he amused himself from five to eight with some of his society; and after that hour he passed the remainder of the time before he went to rest, in hearing some ancient authors read to him; and thus he continued to employ himself till the very day before he died. On the 17th and 18th of May 1786, he was unable to assist at the ordinary reviews, but still he hoped to be present at those of Silesia. He several times attempted to mount his horse to go to the parade at Potzdam; but finding his powers insufficient, he was obliged to return, after having proceeded a few paces. He made other attempts, but with as little success; and at last his disorder terminated in a dropsy. Being now no longer able to remain in bed, he sat day and night in an arm chair with springs which could be moved at pleasure. For near a month before his death the swelling of his feet gave him violent pain, so that he wished an incision to be made; but the surgeon refused to perform the operation, suspecting that it might hasten his death. Nature, however, accomplished his desires; his right leg opened, and discharged such a quantity of matter, that he was greatly relieved: and those unacquainted with the medical art began to entertain hopes of his recovery. The physicians, however, were of a very different opinion; and the event justified their apprehensions. On the 16th of August 1786 his throat began to rattle violently, and his attendants expected every moment that he would breathe his last. In this situation his three secretaries entered the room for the despatch of business as usual. Even then Frederick made an effort to collect his force, giving them a sign to wait, as if he would speak with them in a short time. This, however, was the last he could make: for he soon after fell into a stupor; though from this he recovered so far as to be able to speak. In the evening he asked what o'clock it was? and on being answered that it was nine, he said, "Well then I am going to rest." His respiration and voice became gradually more feeble; and he expired on Thursday at 19 minutes after two in the morning, without any convulsion or symptom of pain.

This great monarch was of the middle size, had large blue eyes and a piercing look. He spoke German incorrectly, and in a very rough manner; but talked French very fluently, and his voice was then mild and agreeable. His constitution was naturally feeble, but he had greatly improved it by his activity and laborious life. He had the art of relieving every one from that embarrassment which frequently occurred in accosting such a celebrated monarch; and it seems probable that he himself considered on what he should say to any illustrious person who happened to come to his court. His universal knowledge enabled him to converse on all subjects; and thus he talked of war with military men, of verses with the poet, of agriculture with the farmer, jurisprudence with the lawyer, commerce with the merchants, and politics with the Englishman. He had a very retentive memory; was fond of solitude and gardening; and likewise took great pleasure in dogs, of which animals he constantly kept a number about him, giving them little balls covered with leather to play with. In company, he was fond of asking questions and jesting; in which last he proceeded such lengths as undoubtedly was unbecoming in a superior towards his inferiors, who would not have failed to resent such jokes from persons more on an equality with them. In military affairs he was excessively severe, not to say cruel; of which the following anecdote may serve as an instance. In the first war of Silesia, wishing to make some alterations in his camp during the night, he forbade every person, under pain of death, to keep, after a certain hour, a fire or other light in his tent. He himself went the rounds; and in passing the tent of a Captain Zietern he perceived a light. Entering the tent, he found the captain sealing a letter to his wife, for whom he had a great affection. "What are you doing there? (says the king): Do you not know the order?" The captain fell on his knees and asked pardon, but did not attempt to make any excuse. "Sit down (says Frederick), and add a few words I am going to dictate to you." Zietern obeyed; and the king dictated, "To morrow I shall perish on a scaffold." The unfortunate man wrote them, and next day was executed. In matters of domestic legislation, he was more arbitrary than just; of which we have a notable example in the

famous

Frederick, Fredericksburg.

famous case of Arnold the miller. The man had refused to pay the rent of the mill he possessed, on pretence that the stream which turned it had been diverted into a fish pond. This was evidently a frivolous excuse; because the water which ran into the pond also ran out of it into the same channel as before, so that nothing could be lost, except what evaporated from the surface of the fish-pond. The judges therefore gave sentence against the miller; but the king not only reversed their sentence, but disgraced them. For this he was celebrated through all the newspapers in Europe; and yet he was in the wrong, and afterwards even acknowledged himself to have been so: but, notwithstanding he knew his error, he not only made no reparation to the parties he had injured, but allowed them to lie in prison at Spandau all his lifetime, so that they were not released till the commencement of the succeeding reign. He entertained certain and almost unaccountable prejudices against certain places and persons, which neither conduct nor merit could eradicate. One of these unfortunate places was Westphalia, on which he never conferred any bounty: and one day a native of that country, a man of great merit, being proposed to him for a place, he refused, saying, "He is a Westphalian; he is good for nothing." Voltaire accuses him of ingratitude to the count de Seckendorf; who, as we have already seen, saved his life, and against whom he afterwards conceived most implacable hatred. His indifference towards those who afforded him the most essential service, was evident: when a robust butcher prevented him from falling, horse and all, over a precipice, where both would have undoubtedly been killed, the king, sensible of the assistance that had been afforded him, turned about, and saying, "Thank you, friend," rode off without ever enquiring farther about the person who had just preserved him from destruction.

With regard to the literary merits of this monarch, we certainly cannot pronounce them extraordinary. Voltaire boasts of having corrected his works, and others of having furnished him with materials for his history. He has been accused of borrowing whole hemistichs of poetry from Voltaire, Boileau, Rousseau, and others; nor does the charge appear to be at all void of foundation. Such of his verses as appear to have undergone no correction, are very indifferent, nor indeed can we pronounce any of his poetic works to be of the first rate. In the former part of his life he entertained a great partiality for the French learning and language; but as he advanced in years, he entirely lost this predilection, and inclined much more to favour the English and Germans. Towards the end of his life, indeed, he affected a contempt for the French, without whom it is said he would scarcely ever have made any figure except in military affairs.

Frederick, is the name of two counties, and of several townships in America, such as the county of Frederick in Maryland, which contains 30,791 inhabitants, in which are included 3641 slaves. It is also the name of a county in Virginia, 30 miles long and 20 broad, with a population of 19,681 souls, including 4250 slaves.

FREDERICKSBURG, a fort and colony of Brandenburg, on the Gold coast of Guinea, in Africa, near Cape Threepoints, and about 75 miles from Cape Coast. It mounts 46 pieces of cannon on four batteries; and formerly belonged to the Prussians, but is now subject to Denmark. W. Long. 1. 15. N. Lat. 6. 40.

Fredericksburg, Free stone.

FREDERICKSHALL, or Frederickstadt, a strong town of Norway, in the prefecture of Agerhuys, where Charles XII. king of Sweden was killed by a musket ball in 1718, when he was besieging this town. It is seated on the coast of the Categate, in E. Long. 10. 45. N. Lat. 59. 2.

FREDERICKSODE, a town of Denmark, in Jutland, taken by the Swedes in 1657, but now subject to Denmark. It is seated near the sea, in E. Long. 99. 44. N. Lat. 55. 35.

FREDERICKSTADT, a town of Denmark, in South Jutland, built in 1621. It is seated on the river Eyder, in E. Long. 9. N. Lat. 54. 28.

Frederickstadt, a town of Norway, in the province of Agerhuys, seated on a bay of the sea, near the frontiers of Sweden, in E. Long. 11. 6. N. Lat. 59. 12.

FREE, in a general sense, is used in opposition to whatever is constrained or necessitated. When applied to things endowed with understanding, it more peculiarly relates to the liberty of the will.

Free Bench, signifies that estate in copyhold which the wife, being espoused a virgin, has after the decease of her husband for her dower, according to the custom of the manor.

In regard to this free bench, different manors have different customs: and in the manor of East and West Enbourne in the county of Berks, and in other parts of England, there is a custom, that when a copyhold tenant dies, the widow shall have her free bench in all the deceased husband's lands, *dum sola et casta fuerit*, "while she lives single and chaste;" but if she is found to be guilty of incontinency, she shall forfeit her estate. Nevertheless, upon her coming into the court of the manor riding backwards on a black ram, with his tail in her hand, rehearsing a certain form of words, the steward is bound by custom to restore her to her free bench. The words are,

Here I am,
Riding on a black Ram,
Like a whore as I am;
And for my crincum crancum
Have lost my bincum bancum,
And for my tail's game
Have done this wordly shame:
Therefore, pray Mr Steward, let me have my land again.

Free or *Imperial Cities*, in Germany, are those not subject to any particular prince; but governed, like republics, by their own magistrates.

There were free cities (*liberæ civitates*) even under the ancient Roman empire: such were those to whom the emperor, by the advice or consent of the senate, gave the privilege of appointing their own magistrates, and governing themselves by their own laws. See City.

Free Fishery. See *Free Fishery*.

Free Warren. See Warren.

Free Mason. See Mason.

Free Stone, a whitish stone, dug up in many parts of of Britain, which is hard and durable, and of excellent use in building, &c. It is a kind of the grit stone, but finer sanded and smoother; and is called *free*, from its being of such a construction as to cut freely in any direction.

The qualities of the several kinds of free stones used in the different parts of Europe are very different. They all agree in this general property, indeed, that they are softer while in the quarry than when they have been some time exposed to the air: but even this general property differs greatly in degree. There is a sort of gray free stone in use at Paris (of which we do not yet seem to have met with any in this country), which has the above-mentioned quality in so great a degree, that the expence of working it is in a great measure saved.

This stone lies everywhere on the south side of the river Seine, and is of a coarse and large grit. It is so soft when newly taken out of the strata, that they fashion it very conveniently with a sort of broad axe, and form as many stones for building in this manner in an hour, as an equal number of our people do in a day or two. Though this stone is as soft as dry clay when first taken up, it is found to harden so considerably in the air, that it becomes more than equal to our ordinary free stone.

The Portland free stone of Britain of the finest kind, which is white and of a close grit, is very fit for hewing and carving; but it will neither resist water nor fire, which is a very singular instance in so dense a stone; while the free stone of Kent, which is less beautiful to the eye, and is of a grayish colour, and considerably close, though of a larger grain, resists the air and water very well. The freestone of Derbyshire, on the other hand, is so brittle as to be unfit for any fine working; and so coarse and open in its texture, that it lets water through: yet it bears the fire extremely well, and is fit for ovens, hearths, &c.

FREEBOOTER, or Flibuster, a name given to the pirates who scour the American seas, particularly such as make war against the Spaniards. See Bucanier.

FREEDOM, in general, the state or quality of being free. See Liberty.

Freedom of a Corporation, the right of enjoying all the privileges and immunities belonging to it. See Corporation.

The freedom of cities, and other corporations, is regularly obtained by serving an apprenticeship; but it is also purchased with money, and sometimes conferred by way of compliment.

Freedom of Conscience. See Toleration.

Freedom of the Will, that power or faculty of the mind, whereby it is capable of acting or not acting, choosing or rejecting whatever it judges proper †. Of this every man must be sensible, who finds in himself a power to begin or forbear, continue or end several actions, barely by a thought or preference of the mind.

† See Metaphysics.

FREEHOLD, Frank Tenement, (*liberum tenementum*), is land, or tenement, which a man holds in *fee-simple*, *fee-tail*, or for term of life. See Fee and Tail.

Freehold is of two kinds, in *deed* and in *law*.

The first is the real possession of land or tenement in fee, fee-tail, or for life: the other is the right a man has to such land or tenement before his entry or seizure.

A freehold, by the common law, cannot commence *in futuro*; but it must take effect presently, either in possession, reversion, or remainder. Whatever is part of the freehold goes to the heir; and things fixed thereto may not be taken in distress for rent, or in execution, &c. No man shall be disseised of his freehold by stat. Magna Charta, cap. 29. but by judgment of his peers, or according to the laws of the land; nor shall any distrain freeholders to answer for their freehold in any thing concerning the same, without the king's writ. Freehold estates, of certain value, are required by statutes to qualify jurors, electors of the knights of the shire in parliament, &c.

Freehold is likewise extended to such offices as a man holds in fee, or for life.

Freehold is also sometimes taken in opposition to villenage.

Lambard observes, that land, in the Saxons time, was distinguished into *bockland*, i. e. holden by book or writing; and *folkland*, held without writing. The former, he says, was held on far better condition, and by the better sort of tenants, as noblemen and gentlemen; being such as we now call *freehold*: the latter was mostly in possession of peasants; being the same with what we now call *at the will of the lord*.

In the ancient laws of Scotland, freeholders are called *milites*, "knights." In Reg. Judicial. it is expressed, that he who holds land upon an execution of a statute merchant, until he hath satisfied the debt, *tenet ut liberum tenementum sibi et assignatis suis*; and the same of a tenant *per elegit*: the meaning of which seems to be, not that such tenants are freeholders, but as freeholders for the time, till they have received profits to the value of their debt.

FREETHINKER. See Deist.

FREEZE, Frieza, or *Frize*, in *Commerce*. See Frize.

Freeze, in *Architecture*, that part of the entablature of columns, between the architrave and corniche.

The freeze is properly a large flat face, or member, separating the architrave from the corniche.

The ancients called it *zoophorus* (ζωφορος) because it was usually enriched with figures of animals; and our denomination *freeze* has a like origin, being formed of the Latin *phrygio*, "an embroiderer," because it is commonly adorned with sculptures in basso relievo, imitating embroidery.

FREEZING, in *Philosophy*, the same with congelation. See Freezing, Chemistry *Index*; and Salts.

Freezing Rain, or *Raining Ice*, a very uncommon kind of shower, which fell in the west of England, in December 1672; whereof we have divers accounts in the Philosophical Transactions.

The rain, as soon as it touched any thing above ground, as a bough or the like, immediately settled into ice, and by multiplying and enlarging the icicles, broke all down with its weight. The rain that fell on the snow immediately froze into ice, without sinking in the snow at all.

It made an incredible destruction of trees, beyond any thing in all history. "Had it concluded with some gust of wind (says a gentleman on the spot), it might

might have been of terrible consequence. I weighed the sprig of an ash tree, of just three quarters of a pound; the ice on which weighed 16 pounds. Some were frighted with the noise in the air; till they discerned it was the clatter of icy boughs, dashed against each other." Dr Beale observes, that there was no considerable frost observed on the ground during the whole; whence he concludes, that a frost may be very intense and dangerous on the tops of some hills and plains, while in other places it keeps at two, three, or four feet distance above the ground, rivers, lakes, &c. and may wander about furious in some places and remiss in others not far off. The frost was followed by glowing heats, and a wonderful forwardness of flowers and fruits.

FREIGHT, in *Navigation* and *Commerce*, the hire of a ship, or a part thereof, for the conveyance and carriage of goods from one port or place to another; or the sum agreed on between the owner and the merchant, for the hire and use of a vessel. See *Maritime Laws*.

FREIND, John, a most learned English physician and writer of the 18th century, was born at Croton, Northamptonshire, in 1675. In 1696, he published, in conjunction with Mr P. Foulkes, an edition of two Greek orations, one of Æschines against Ctesiphon, and the other of Demosthenes *de Corona*, with a new Latin version. In 1699, he wrote a letter to Dr Solane concerning an *Hydrocephalus*, published in the Philosophical Transactions; and another letter in Latin to the same gentleman, *De spasmis rarior. historia*, printed in the same Transactions. In 1703, his *Emmenalogia* appeared, which gained him great reputation. In 1704, he was chosen professor of chemistry in the university of Oxford. In 1705 he attended the earl of Peterborough to Spain, as physician to the army there; and, upon his return in 1707, published an account of the earl's expedition and conduct. In 1709 he published his Chemical Leetures. In 1712 he attended the duke of Ormond in Flanders, as his physician. In 1716 he was admitted a fellow of the College of Physicians in London. This year he published the first and third books of Hippocrates *De morbis popularibus*, with a Commentary on Fevers, written by himself. He sat member for the borough of Launceston in Cornwall in 1722, where he distinguished himself by his opposition to the administration. March 1722, he was committed to the Tower on a charge of high treason; and while he was under confinement, he wrote a Latin epistle to Dr Mead, *de quibusdam variolarum generibus;* and began his History of Physic, the first part of which was published in 1725, and the second in 1726. Upon the accession of George II. to the throne, he was appointed physician in ordinary to the queen, who showed the utmost regard and esteem for him. He died at London in 1728. His works were published together in Latin at London, 1733, in folio, and dedicated to the queen.

FREITS. See Freats.

FRENCH, in general, something belonging to France: thus we say, the French language, French custom, polity, &c.

The French language, as it now stands, is no original or mother language, but a medley of several. Those that prevail most, and which are, as it were, the basis thereof are, 1. The Celtic; whether that were a particular language itself, or whether it were only a dialect of the Gothic, as spoke in the west and north. 2. The Latin, which the Romans carried with them into Gaul, when they made the conquest thereof. And, 3. The Teutonic, or that dialect of the Teutonic spoke by the Franks, when they passed the Rhine, and established themselves in Gaul. Of these three languages, in the space of about thirteen hundred years, was the present French formed, such as it is now found. Its progress was very slow; and both the Italian and Spanish were regular languages long before the French.

Pasquier observes, it was under Philip de Valois that the French tongue first began to be polished; and that, in the register of the chamber of accounts of that time, there is a purity seen almost equal to that of the present age. However, the French was still a very imperfect language till the reign of Francis I.; the custom of speaking Latin at the bar, and of writing the public acts and instruments of the courts of justice in that language, had made them overlook the French, their own language. Add that the preceding ages had been remarkable for their ignorance, which was owing, in a good measure, to the long and calamitous wars which France had been engaged in; whence the French noblesse deemed it a kind of merit not to know any thing; and the generals regarded little whether or not they wrote and talked politely, provided they could but fight well.

But Francis I. who was the restorer of learning, and the father of the learned, changed the face of things; and after his time, Henry Stevens printed his book, *De la Precellence du Langage François*. The change had become very conspicuous at the end of the 16th century; and under Henry IV. Amyot, Coeffeteau, and Malherbe, contributed towards bringing it to its perfection; which the Cardinal de Richelieu completed, by the establishment of the French academy; an assembly, wherein the most distinguished persons of the church, the sword, and the gown, have been members. Nor did the long reign of Louis XIV. contribute a little to the improvement of the language; the personal qualities of that prince, and his taste for the fine arts, and that of the princes of the blood, rendered his court the politest in Europe. Wit and magnificence seemed to vie; and his generals might have disputed with the Greeks, Romans, &c. the glory of writing well, if they could not that of fighting. From court, the elegance and purity of the language soon spread itself into the provinces; and now there is scarce anybody there who does not write and speak good French.

One of the characters of the French language is, to be natural and easy. The words are ranged in it much in the same order as the ideas in our minds; in which it differs exceedingly from the Greek and Latin, where the inversion of the natural order of words is reputed a beauty. Indeed the Hebrew surpasses even the French in this point; but then it comes short of it in copiousness and variety.

It must be added, however, that as to the analogy of grammar, and the simplicity wherewith the moods of verbs are formed, the English has the advantage not only over the French, but over all the known languages in in the world; but then the turns, the expressions, and the idioms of the English, are sometimes so quaint and extraordinary, that it loses a good deal of the advantage which its grammatical simplicity gives it over the rest.

The French has but few compound words; wherein it differs widely from the Greek, High Dutch, and English. This the French authors own a great disadvantage in their language; the Greek and Dutch deriving a great part of their force and energy from the composition of words, and frequently expressing that in one sounding word, which the French cannot express but by a periphrasis. The diminutives in the French are as few as the compounds; the greatest part of those remaining in use having lost their diminutive signification; but what distinguish the French most, are its justness, purity, accuracy, and flexibility.

French is the most universal and extensive language in Europe. The policy of states and courts has rendered it necessary for the ministers of princes, and their officers, &c. and the taste of arts and sciences has had the same effect with regard to the learned. In Germany, and elsewhere, the princesses and persons of distinction value themselves on understanding French; and in several courts of Europe, French is almost as much known as the language of the country.

FRESCATI, or FRASCATI, a small town, situated on the brow of a hill, about twelve miles to the eastward of Rome. It derives its name from the coolness of the air, and *fresh* verdure of the fields around. It is built of the ruins of the ancient Tusculum; and the Tusculan villa where Cicero wrote his famous questions is at a place now called *Grotta Ferrata*, about two miles distant. E. Long. 11. 43. N. Lat. 41. 48. There is a very fine prospect from this town into the neighbouring country, which abounds with the seats of cardinals and other nobility. It is the see of a bishop, who is one of the six senior cardinals, and is surrounded by some of the most beautiful villas in Italy; the principal of which are the villa Aldobrandini, belonging to Prince Pamfili; the villa Taberna, belonging to Prince Borghese; and villa Ludovisi, to the family of Colonna. The villa Aldobrandini, called also *Belvedere* from its beautiful prospect, is the most remarkable, on account of its fine situation, extensive gardens, airy terraces, its grottoes, cascades, and water-works. Over a saloon, near the grand cascade, is the following inscription:

Huc ego migravi musis comitatus Apollo;
Hìc Delphi, hìc Helicon, hìc mihi Delos erit.

The walls are adorned with a representation of Apollo and the Muses; and some of that god's adventures are painted in fresco by Domenichino. The villa Taberna is one of the finest and best furnished of any in the neighbourhood of Rome. From this you ascend through gardens to Monte Dracone, another palace on a more lofty situation, belonging also to that prince, and deriving its name from the arms of his family. From hence you may see Rome, and the whole extent of the plain; it has a noble ascent, with a broad paved walk; and among other curiosities there is a hall adorned with the pictures of a vast number of men eminent for learning and arms. The gardens, laid out by Vignola, contain three miles in compass; and have many delightful walks and curious water-works. Near this place are the monks of Camaldoli and the capuchins; and higher up are ruins of the ancient Tusculum. Ascending towards the plain, two miles on the right hand, you find the famous abbey of Grotta Ferrata, belonging to the monks of St Basil, and situated on the ruins of Cicero's house. The Virgin Mary of the great altar is an ancient Greek picture; in the chapel the pictures of St Nilus and St Bartholomew the abbot, are by Annibal Caracci; and all the paintings in fresco of this chapel are by Domenichino. Villa Ludovisi has a charming walk going up to it, where you see the ruins of Lucullus's palace. The house is small; but the gardens are large, embellished with a great variety of walks and fountains, and a beautiful cascade.

FRESCO, a method of painting in relievo on walls, so as to endure the weather. It is performed with water-colours on fresh plaster, or on a wall laid with mortar not yet dry. This sort of painting has a great advantage by its incorporating with the mortar; and drying along with it, becomes very durable. The Italians, from whom we borrow the term, call it *fresco;* because it is frequently used for walls, alcoves, and other buildings in the *open air.* Vitruvius, lib. vii. cap. 4. calls it *udo tectorio.*

Painting in fresco is very ancient, having been practised in the earliest ages of Greece and Rome. It is chiefly performed on walls and vaults, newly plastered with lime and sand; but the plaster is only to be laid, in proportion as the painting goes on; no more being to be done at once than the painter can despatch in a day, while it dries. Before he begins to paint, a cartoon or design is usually made on paper, to be chalked, and transferred to the wall, about half an hour after the plaster is applied.

The ancients painted on stucco; and we may remark in Vitruvius what infinite care they took in making the incrustation or plastering of their buildings to render them beautiful and lasting; though the modern painters find a plaster of lime and sand preferable to it; both as it does not dry so hastily, and as being a little brownish, it is fitter to lay colours on, than a ground so white as stucco.

In this kind of painting all the compound and artificial colours, and almost all the minerals, are set aside, and scarce any thing is used but earths; which are capable of preserving their colour, defending it from the burning of the lime, and resisting its salt, which Vitruvius calls its bitterness.

For the work to come out in all its beauty, the colours must be laid on quick, while the plaster is yet moist; nor should they ever be retouched dry, with colours mixed up with the white of an egg, or size, or gum, as some workmen do; because such colours grow blackish; nor do any preserve themselves, but only such as were laid on hastily at first.

The colours used are white made of lime slaked long before, and white marble dust; ochre, both red and yellow; verditer; lapis lazuli; smalt; black chalk, &c. All which are only ground, and worked up with water; and most of them grow brighter and brighter as the fresco dries.

The brushes and pencils for this work ought to be

 long

long and soft, otherwise they will rake and raise the painting. The colours should be full, and flowing from the brush; and the design perfect; for in this work you cannot alter or add upon any colour.

FRESH WATER, is that not tinctured or impregnated with salt or saline particles enough to be discovered by the sense. Such generally is that of springs, rains, wells, lakes, &c.

The dulcifying or making of salt water fresh is a secret that has been long sought with great attention. For an account of the principal attempts that have been made with this view, see *Sea Water*.

Fresh Wind signifies strong, but not violent; hence when the gale increases, it is said to freshen.

FRESHES, in sea language, denotes the impetuosity of an ebb tide, increased by heavy rains, and flowing out into the sea, often discolouring it to a considerable distance, and forming a line that separates the two colours, and which may be distinctly perceived for a great length along the coast.

FRESHES, a local term signifying annual inundations, from the river being swollen by the melted snows and other fresh waters from the uplands, as is the Nile, &c. from periodical or tropical rains. As a sailor's term, it is opposed to marine or salt water floodings, tides, &c. The word is of common use in America, where the inundations so called are of great service. They bring down the soil to the intervals below, and form a fine mould, producing corn, grain, and herbage, in the most luxuriant plenty. They also afford another benefit, in regard to many rivers in America, viz. in equalizing the surface of the stream (where rapid falls, or cascades, obstruct the navigation), so that rafts of timber and other gross produce are then floated down to the sea ports in great quantities.

FRESNOY, CHARLES ALPHONSE DU, an excellent poet and painter, was born at Paris in 1611. He was instructed there by Perrier and Simon Vouet in painting; but he did not long adhere to Vouet's manner of colouring; for as soon as he fixed himself at Rome, he made the works of Titian the models for his imitation. He was, however, more celebrated as a poet than as a painter; and gave more attention to the theory than to the practice of the pencil. Accordingly he is better known by his incomparable poem *De arte graphica*, than by his performances on the canvas: and on this poem he bestowed so much pains, that he died in 1665, before it was published. It was printed afterwards with a French prose translation and notes by M. de Piles; and was translated into English by Mr Dryden, who prefixed to it an original preface containing a parallel between painting and poetry.

FRET, or FRETTE, in *Architecture*, a kind of knot or ornament, consisting of two lists or small fillets variously interlaced or interwoven, and running at parallel distances equal to their breadth.

FRET, in *Heraldry*, a bearing composed of six bars, crossed and variously interlaced. Some call it the *true-lover's knot*. See HERALDRY.

FRET, in *Music*, signifies a kind of stop on some instruments, particularly bass viols and lutes. Frets consist of strings tied round the neck of the instrument, at certain distances, within which such and such notes are to be found.

FRET-*Work*, that adorned with frets. It is sometimes used to fill up and enrich flat empty spaces; but it is mostly practised in roofs, which are fretted over with plaster work.

FRETTS, in *Mineralogy*, a term used by our miners to express the worn side of the banks of the rivers in mine countries, where they search for the shoad stones or grewts washed down from the hills, in order from thence to trace out the running of the shoad up to the mine.

FRETTS, *Freats* or *Freits*. See FREATS.

FREYBERG, or FRIEDBERG, a town in the circle of Upper Saxony, containing upwards of 9000 people. There are mines of copper, tin, lead, and silver, in its vicinity, which afford employment to a considerable number of workmen, and produce an annual revenue of more than 10,000 rix-dollars. The princes of the house of Saxony are usually buried here, where there is also an academy for the study of mineralogy, instituted in the year 1765, and reckoned the most famous for that science of any in Germany. It is situated on a branch of the Muldau, 19 miles south-west of Dresden, in N. Lat. 51. and E. Long. 13. 18.

FRIABLE, among naturalists, an appellation given to bodies that are easily crumbled to pieces: such are pumice and all calcined stones.

FRIAR, or FRIER, by the Latins called *frater*, the Italians *fra*, and the French *frere*, that is, *brother*: a term common to the monks of all orders; founded on this, that there is a kind of fraternity or brotherhood presumed between the several religious persons of the same convent or monastery.

Friars are generally distinguished into these four principal branches, viz. 1. Minors, Gray friars, or Franciscans. 2. Augustines. 3. Dominicans, or Black friars. 4. White friars or Carmelites. From these four the rest of the orders descend. See FRANCISCANS, AUGUSTINES, &c.

FRIAR, in a more peculiar sense, is restrained to such monks as are not priests; for those in orders are usually dignified with the appellation of *father*.

FRIARS *Observant* (*fratres observantes*) were a branch of the Franciscans; thus called, because not combined together in any cloister, convent, or corporation, as the conventuals are; but only agreed among themselves to observe the rules of their order, and that more strictly than the conventuals did, from whom they separated themselves out of a singularity of zeal, living in certain places of their own choosing.

FRIBURG, a large town of Germany, and capital of Brisgaw; remarkable for the steeple of the great church, which, next to that of Strasburg, is the finest in Germany; and for its university. The inhabitants are famous for polishing crystal and precious stones. It has been several times taken and retaken; particularly by the French in 1744, who demolished the fortifications. It was also taken by them in June 1796. It is seated on the river Triset, ten miles east of Brisach, and 26 south of Strasburg. E. Long. 7. 57. N. Lat. 48. 4.

FRIBURG, a town of Swisserland, and capital of the canton of the same name, seated on the river Sane, in E. Long. 6. 48. N. Lat. 46. 50. Its situation is most singular and picturesque: "It stands partly in a small plain, partly on bold acclivities on a ridge

Cox's Trav. Swisserland

ridge of rugged rocks, half encircled by the river Sane; and is so entirely concealed by the circumjacent hills, that the traveller scarcely catches the smallest glimpse, until he bursts upon a view of the whole town from the overhanging eminence. The fortifications, which consist of high stone walls and towers, enclose a circumference of about four miles, within which space the eye comprehends a singular mixture of houses, rocks, thickets, and meadows, varying instantly from wild to agreeable, from the bustle of a town to the solitude of the deepest retirement. The Sane winds in such a serpentine manner as to form in its course, within the space of two miles, five obtuse angles, between which the intervening parts of the current are parallel to each other. On all sides the descent to the town is extremely steep: in one place the streets even pass over the roofs of the houses. Many of the edifices are raised in regular gradation like the seats of an amphitheatre; and many overhang the edge of a precipice in such a manner, that on looking down, a weak head would be apt to turn giddy. But the most extraordinary point of view is from the Pont-neuf. To the north-west, part of the town stands boldly on the sides and the piked back of an abrupt ridge; and from east to west a semicircle of high perpendicular rocks is seen, whose base is washed and undermined by the winding Sane, and whose tops and sides are thinly scattered with shrubs and underwood. On the highest point of the rocks, and on the very edge of the precipice, appears, half hanging in the air, the gate of the town called *Bourguillon*: a stranger standing on the bridge would compare it to Laputa, or the Flying island in Gulliver's Travels; and would not conceive it to be accessible but by means of a cord and pulleys. The houses, constructed with a gray sand stone, are neat and well built; and the public edifices, particularly the cathedral, are extremely elegant. The inhabitants are Roman Catholics, as are those of the whole canton. The bishop of Lausanne, called here the bishop of Friburg, resides in this city. He is appointed by the pope, usually at the recommendation of the French court: and his revenues, including a small pension from France, and from the abbey of Hauterive, of which he was abbot, amount to about 400l. per annum. His diocese extends over the whole canton, and part of that of Soleure. In all his acts and deeds he signs himself bishop and count of Lausanne, and prince of the German empire. The sovereign power resides in the great council of two hundred; comprising the two advoyers, the chancellor, the grand sautier, the senate or little council of twenty-four, the sixty, from which body are chosen the bannerets and principal magistrates, and the remaining hundred and twelve members, who are simply denominated burghers."

FRIBURG, *the Canton of*, one of the 13 republics of Switzerland. It is surrounded on all sides by the canton of Bern. The land is fertile in corn, fruits, and pastures; and it is said the canton can send 18,000 men into the field. This canton is entirely Catholic.

FRICASSEE, a dish or mess hastily dressed in a frying pan, and seasoned with butter, oil, or the like. The word is French, formed of the Latin *frixatura*, "frying." Others will have fricassee formed in imitation of the noise made by butter, or other fat, when melted in the pan. We say a fricassee of pullets, of rabbits, of tench, of tripe, of frogs, of eggs, of peas, &c.

FRICENTI, an episcopal town of Italy, in the kingdom of Naples, and in the farther principato, near the river Tripalto, in E. Long. 15. 2. N. Lat. 40. 59.

FRICTION, the act of rubbing or grating the surface of one body against that of another, called also *attrition*. The phenomena arising upon the friction of divers bodies, under different circumstances, are very numerous and considerable. Mr Hawksbee gives us a number of experiments of this kind; particularly of the attrition or friction of glass, under various circumstances, the result of which was, that it yielded light and became electrical. All bodies by friction produce heat; many of them emit light; particularly a cat's back, sugar, beaten sulphur, mercury, sea water, gold, copper, &c. but, above all, diamonds, which, when briskly rubbed against glass, gold, or the like, yield a light equal to that of a live coal when blowed by the bellows. See ELECTRICS and ELECTRICITY.

FRICTION, in *Mechanics*, denotes the resistance a moving body meets with from the surface on which it moves. Friction arises from the roughness or asperity of the surface of the body moved on, and that of the body moving: for such surfaces consisting alternately of eminences and cavities, either the eminences of the one must be raised over those of the other, or they must be both broke and worn off: but neither can happen without motion, nor can motion be produced without a force impressed. Hence, the force applied to move the body is either wholly or partly spent on this effect: and consequently there arises a resistance or friction, which will be greater, *cæteris paribus*, as the eminences are the greater and the substance the harder: and as the body, by continual friction, becomes more and more polished, the friction diminishes. See MECHANICS.

FRICTION, in *Medicine* and *Surgery*, denotes the act of rubbing a diseased part with oils, unguents, or other matters, in order to ease, relieve, and cure it. Frictions are much used of late in venereal cases. They prefer the applying of mercury externally by way of friction, to that of giving it internally, to raise a salivation.

There are also frictions with the flesh brush, a linen cloth, or the hand only. These frictions are a sort of exercise which contributes greatly to health; as they excite and stir up the natural warmth, divert defluxions, promote perspiration, open the pores of the skin, and carry off stagnant humours.

The flesh brush (Dr Cheyne observes) is an exercise extremely useful for promoting a full and free perspiration and circulation. Every body knows the effect of currying horses; that it makes them sleek, gay, lively, and active; so as even to be judged equivalent to half the feeding. This it can no otherwise effect, but by assisting nature to throw off the recrements of the juices, which stop the free circulation, and, by constant friction, irritation, and stimulation, to bring the blood and spirits to the parts most distant from the seat of heat and motion; and so plump up the superficial muscles. And the same effect it would have in other creatures, and man himself, if managed in the same manner, and with the same care and regularity.

Persons

Persons, therefore, of weak nerves and sedentary lives, would do well to supply the want of other exercise with spending half an hour, morning and night, in currying and rubbing their whole body, especially their limbs, with a flesh brush. But this means of health is most advantageously used when the *primæ viæ* are most empty.

FRIDAY, the sixth day of the week; so named of *Freya*, a Saxon deity. By the Romans it was called *dies Veneris*. See FREA.

*Good-*FRIDAY. See *Good-Friday*.

FRIDSTOL, mentioned, in our ancient writers, among the immunities granted to churches, signifies a seat, chair, or place of peace and security, where criminals might find safety and protection: of these there were many in England: but the most famous were that at Beverly, and that in St Peter's church at York, granted by charter of King Henry I.

FRIEDENSHUETTEN, a Moravian settlement, whose name signifies *tents of peace*, situated on the Susquehannah river in Pennsylvania, about 24 miles below Tioga point, which owed its origin to the united brethren, in the year 1765. At that period it contained 13 huts belonging to the Indians, besides 40 houses constructed after the European manner, and a very neat chapel.

FRIENDLY ISLANDS, a cluster of islands in the Pacific ocean, so named by Captain Cook in the year 1773, on account of the friendship which appeared to subsist among the inhabitants, and from their courteous behaviour to strangers. Abel Jansen Tasman, an eminent Dutch navigator, first touched here in 1643, and gave names to the principal islands. Captain Cook laboriously explored the whole cluster, which he found to consist of more than 60. The three islands which Tasman saw he named *New Amsterdam*, *Rotterdam*, and *Middleburgh*. The first is the largest, and extends about 21 miles from east to west, and about 13 from north to south. These islands are inhabited by a race of Indians, who cultivate the earth with great industry. The island of Amsterdam is intersected by a straight and pleasant road with fruit trees on each side, which provide shade from the scorching heat of the sun. The chief islands are Annamooka, Tongataboo (the residence of the sovereign and the chiefs), Lefooga, and Eooa. Lefooga is about seven miles long, and in some places not above two or three broad. It is in many respects superior to Annamooka. The plantations are both more numerous and more extensive; and enclosed by fences which, running parallel to each other, form fine spacious public roads, which would appear beautiful in countries where rural conveniences have been carried to the highest perfection. They are, in general, highly cultivated, and well stocked with the several roots and fruits which these islands produce; and Captain Cook endeavoured to add to their number, by planting Indian corn, and the seeds of melons, pumpkins, and the like. Eooa, when viewed from the ship at anchor, formed one of the most beautiful prospects in nature, and very different from the others of the Friendly Isles; which being low, and perfectly level, exhibit nothing to the eye but the trees which cover them: whereas here, the land rising gently to a considerable height, presents us with an extensive prospect, where groves of trees are only interspered at irregular distances, in beautiful disorder, and all the rest is covered with grass, except near the shores, where it is entirely covered with fruit and other trees; amongst which are the habitations of the natives. In order to have a view of as great a part of the island as possible, Captain Cook and some of his officers walked up to the highest point of the island. From this place they had a view of almost the whole island, which consisted of beautiful meadows of prodigious extent, adorned with tufts of trees, and intermixed with plantations. 'While I was surveying this delightful prospect (says Captain Cook), I could not help flattering myself with the pleasing idea that some future navigator may, from the same station, behold these meadows stocked with cattle, brought to these islands by the ships of England; and that the completion of this single benevolent purpose, independent of all other considerations, would sufficiently mark to posterity, that our voyages had not been useless to the general interests of humanity. 'The next morning,' says our benevolent commander, 'I planted a pine apple, and sowed the seeds of melons and other vegetables in Taoofa's plantation. I had indeed some encouragement to flatter myself that my endeavours of this kind also would not be fruitless: as I had this day a dish of turnips served up at my dinner, which was the produce of seeds I left here in my former voyage.'

The natives of these islands seldom exceed the common stature; but are very strong and well made, especially as to their limbs. They are generally broad about the shoulders; and though the muscular disposition of the men, which seems a consequence of much action, rather conveys the appearance of strength than of beauty, there are several to be seen who are really handsome. The women are not so much distinguished from the men by their features as by their general form, which is for the most part destitute of that strong fleshy firmness that appears in the latter. The features of some are so delicate, as not only to be a true index of their sex, but to lay claim to a considerable share of beauty and expression: for the bodies and limbs of most of the females are well proportioned; and some absolutely perfect models of a beautiful figure. But the most remarkable distinction in the women is the uncommon smallness and delicacy of their fingers, which may be put in competition with the finest in Europe. The general colour is a cast deeper than the copper brown; but several of the men and women have a true olive complexion: and some of the last are even a great deal fairer. Their countenances very remarkably express the abundant mildness or good nature which they possess; and are entirely free from that savage keenness which marks nations in a barbarous state. They are frank, cheerful, and good-natured.

There are, upon the whole, few natural defects or deformities to be found among these people. The most common is the tetter or ring worm, that seems to affect almost one half of them, and leaves whitish serpentine marks everywhere behind it; but this is of less consequence than another which is very frequent, and appears on every part of the body. Captain Cook had the mortification to learn that all the care he took when he first visited these islands, to prevent the venereal disease from being communicated to the inhabitants, tenants, had proved ineffectual. What is extraordinary, they do not seem to regard it much; and as there appeared few signs of its destroying effects, probably the climate, and the way of living of these people, greatly abated its virulence. There are two other complaints frequent amongst them; one of which is an indolent firm swelling, that affects the legs and arms, and increases them to an extraordinary size in their whole length. The other is a tumor of the same sort in the testicles, which sometimes exceeds the size of the two fists. But in other respects they may be considered as uncommonly healthy.

Their hair is in general straight, thick, and strong, though a few have it bushy or frizzled. The natural colour is black; but the greatest part of the men, and some of the women, have it stained of a brown or purple colour, and a few of an orange cast. They wear it variously cut. Some have it cut off on one side of the head only; others have it entirely cut off except a single lock; the women in general wear it short. The men have their beards cut short; and both men and women strip the hair from the armpits. The men are stained from about the middle of the belly to about half way down the thighs with a deep blue colour. The women have only a few small lines or spots thus imprinted on the inside of their hands. Their kings, as a mark of distinction, are exempted from this custom.

The men are all circumcised, or rather supercised, as the operation consists in cutting off only a small piece of the foreskin at the upper part: which by that means is rendered incapable ever after of covering the glans. This is all they aim at, as they say the operation is practised from a notion of cleanliness.

The dress of both men and women is the same: and consists of a piece of cloth or matting (but mostly the former) about two yards wide and two and a half long: at least so long as to go once and a half round the waist, to which it is confined by a girdle or cord. It is double before, and hangs down like a petticoat, as low as the middle of the leg. The upper part of the garment above the girdle is plaited into several folds; so that, when unfolded, there is cloth sufficient to draw up and wrap round the shoulders; which is very seldom done. The inferior sort are satisfied with small pieces; and very often wear nothing but a covering made of leaves of plants, or the maro, which is a narrow piece of cloth or matting like a sash. This they pass between the thighs and wrap round the waist; but the use of it is chiefly confined to the men. The ornaments worn by both sexes are necklaces made of the fruit of the pandanus, and various sweet smelling flowers, which go under the general name of *kahulla.* Others are composed of small shells, the wing and leg-bones of birds, sharks teeth and other things; all which hang loose upon the breast; rings of tortoise shell on the fingers; and a number of these joined together as bracelets on the wrists. The lobes of the ears (though most frequently only one), are sometimes perforated with two holes, in which they wear cylindrical bits of ivory about three inches long.

Cleanliness induces them to bathe in the ponds, which seem to serve for no other purpose. They are sensible that salt water hurts their skin; and when necessity obliges them to bathe in the sea, they commonly have some cocoa nut shells filled with fresh water poured over them to wash it off. People of superior rank use cocoa nut oil, which improves the appearance of the skin very much.

The employment of the women is of the easy kind, and, for the most part, such as may be executed in the house. The manufacturing their cloth is wholly consigned to their care; as is also that of their mats, which are esteemed both for their texture and their beauty. There are many other articles of less note that employ the spare time of their females; as combs, of which they make vast numbers, and little baskets with small beads; but all finished with such neatness and taste in the disposition of the various parts, that a stranger cannot help admiring their assiduity and dexterity.

The province allotted to the men, as might be expected, is far more laborious and extensive than that of the women. Agriculture, architecture, boat building, fishing, and other things that relate to navigation, are the objects of their care. Cultivated roots and fruits being their principal support, this requires their constant attention to agriculture, which they pursue very diligently, and seem to have brought almost to as great perfection as circumstances will permit. In planting the plantains and yams, they observe so much exactness, that, which ever way you look, the rows present themselves regular and complete. The cocoa nut and bread fruit trees are scattered about without any order, and seem to give them no trouble after they have attained a certain height.

The houses of the lower people are poor huts, and very small; those of the better sort are larger and more moderate. The dimensions of one of a middling size are about 30 feet long, 20 broad, and 12 high. Their house is, properly speaking, a thatched roof or shed, supported by posts and rafters, disposed in a very judicious manner. The floor is raised with earth smoothed, and covered with thick strong matting, and kept very clean. A thick strong mat, about two and a half or three feet broad, bent into the form of a semicircle, and set upon its edge, with the ends touching the side of the house, in shape resembling the fender of a fire heath, encloses a space for the master and mistress of the family to sleep in. The rest of the family sleep upon the floor, wherever they please to lie down; the unmarried men and women apart from each other: Or if the family be large, there are small huts adjoining, to which the servants retire in the night; so that privacy is as much observed here as one could expect. The clothes that they wear in the day serve for their covering in the night. Their whole furniture consists of a bowl or two, in which they make kava; a few gourds; cocoa nut shells; and some small wooden stools, which serve them for pillows.

They display much ingenuity in the building of their canoes, as well as in the navigating them.

The only tools which they use to construct them, which are very dexterously made, are hatchets, or rather thick adzes, of a smooth black stone that abounds at Toofoa; augres, made of sharks teeth, fixed on small handles, and rasps of a rough skin of a fish, fastened on flat pieces of wood, thinner on one side, which also have handles. The cordage is made from the fibres of the cocoa nut husk, which, though not more than nine or ten inches long, they plait, about the size of a

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a quill, or less, to any length that they please, and roll it up in balls, from which the larger ropes are made by twisting several of these together. The lines that they fish with are as strong and even as the best cord we make, resembling it almost in every respect. Their other fishing implements are large and small hooks made of pearl shell. Their weapons are clubs of different sorts, (in the ornamenting of which they spend much time), spears and darts. They have also bows and arrows; but these seemed to be designed only for amusement, such as shooting at birds, and not for military purposes. The stools are about two feet long, but only four or five inches high, and near four broad, bending downward in the middle, with four strong legs, and circular feet; the whole made of one piece of black or brown wood, neatly polished, and sometimes inlaid with bits of ivory.

Yams, plantains, and cocoa nuts, composed the greatest part of their vegetable diet. Of their animal food, the chief articles are, hogs, fowls, fish, and all sorts of shell fish; but the lower people eat rats. The two first vegetable articles, with bread fruit, are what may be called the basis of their food, at different times of the year, with fish and shell fish; for hogs, fowls, and turtle, seem only to be occasional dainties, reserved for their chiefs. Their food is generally dressed by baking, and they have the art of making, from different kinds of fruit, several dishes which most of us esteemed very good. The generality of them lay their victuals upon the first leaf they meet with, however dirty it may be; but when food is served up to the chiefs, it is commonly laid upon green plantain leaves. The women are not excluded from eating with the men; but there are certain ranks or orders amongst them that can neither eat nor drink together. This distinction begins with the king; but where it ends could not be learnt. They seem to have no set time for meals. They go to bed as soon as it is dark, and rise with the dawn in the morning.

Their private diversions are chiefly singing, dancing, and music performed by the women. The dancing of the men has a thousand different motions with the hands, to which we are entire strangers; and they are performed with an ease and grace which are not to be described but by those who have seen them.

Whether their marriages be made lasting by any kind of solemn contract, our voyagers could not determine with precision; but it appeared that the bulk of the people satisfied themselves with one wife. The chiefs, however, have commonly several women, though it appeared as if one only was looked upon as the mistress of the family.

When any person of consequence dies, his body is washed and decorated by some woman or women, who are appointed on the occasion; and these women are not, by their customs, to touch any food with their hands for many months afterwards; and it is remarkable, that the length of the time they are thus proscribed, is the greater in proportion to the rank of the chief whom they had washed.

The concern of these people for the dead is most extraordinary. They beat their teeth with stones, strike a shark's tooth into the head until the blood flows in streams, and thrust spears into the inner part of the thigh, into their sides below the armpits, and through the cheeks into the mouth. All these operations convey an idea of such rigorous discipline, as must require either an uncommon degree of affection, or the grossest superstition, to exact. It should be observed, however, that the more painful operations are only practised on account of the death of those most nearly connected.

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Their long and general mourning proves, that they consider death as a very great evil. And this is confirmed by a very odd custom which they practise to avert it. They suppose that the Deity will accept of the little finger, as a sort of sacrifice efficacious enough to procure the recovery of their health. They cut it off with one of their stone hatchets. There appeared scarcely one in ten of them who was not thus mutilated in one or both hands. According to Captain King, it is common also for the inferior people to cut off a joint of their little finger on account of the sickness of the chiefs to whom they belong.

They seem to have little conception of future punishment. They believe, however, that they are justly punished upon earth; and consequently use every method to render their divinities propitious. The Supreme Author of all things they call *Kallafootonga*; who, they say, is a female residing in the sky, and directing the thunder, wind, rain, and in general all the changes of weather. They believe that when she is angry with them, the productions of the earth are blasted; that many things are destroyed by lightning; and that they themselves are afflicted with sickness and death as well as their hogs and other animals. When this anger abates, they suppose that every thing is restored to its natural order. They also admit a plurality of deities, though all inferior to *Kallafootonga*. They have less absurd sentiments about the immateriality and the immortality of the soul. They call it *life*, the living principle; or, what is more agreeable to their notions of it, *Otooa*; that is, a divinity or invisible being.

Of the nature of their government no more is known than the general outline. According to the information received, the power of the king is unlimited, and the life and property of the subject are at his disposal; and instances enough were seen to prove that the lower order of people have no property, nor safety for their persons, but at the will of the chiefs to whom they respectively belong. When any one wants to speak with the king or chief, he advances and sits down before him with his legs across; which is a posture to which they are so much accustomed, that any other mode of sitting is disagreeable to them. To speak to the king standing would be accounted here a striking mark of rudeness.

Though some of the more potent chiefs may vie with the king in point of actual possessions, they fall very short in rank and in certain marks of respect, which the collective body have agreed to pay the monarch. It is a particular privilege annexed to his sovereignty, not to be punctured nor circumcised, as all his subjects are. Whenever he walks out, every one whom he meets must sit down till he has passed. No one is allowed to be over his head; on the contrary all must come under his feet; for there cannot be a greater outward mark of submission than that which is paid to the sovereign and other great people of these islands by by their inferiors. The method is this: the person who is to pay obeisance squats down before the chief, and bows the head to the sole of his foot; which, when he sits, is so placed that it cannot easily be come at; and having tapped or touched it with the under and upper side of the fingers of both hands, he rises up and retires. The hands, after this application of them to the chief's feet, are in some cases rendered useless for a time; for, until they be washed, they must not touch any kind of food. When the hands are in this state, they call it *taboo rema*. *Taboo*, in general, signifies "forbidden," and *rema* is their word for "hand." Their great men are fond of a singular piece of luxury; which is, to have women sit beside them all night, and beat on different parts of their body until they go to sleep; after which they relax a little of their labour, unless they appear likely to awake; in which case they redouble their drumming until they are again fast asleep.

Definition of friendship.

FRIENDSHIP may be defined, a mutual attachment subsisting between two persons: and arising, not merely from the general principle of benevolence, from emotions of gratitude for favours received, from views of interest, or from instinctive affection or animal passion; but from an opinion entertained by each of them, that the other is adorned with some amiable or respectable qualities.

Illustration of the above definition.

The object of the general principle of benevolence is *mankind*, not any particular individual. Gratitude regards the person from whom he who feels its emotions has received a favour, whether that person be a virtuous or vicious, a respectable or a contemptible, character: it prompts the person obliged to make a suitable return to his benefactor, but not to enter into any particular intimacy with him, merely on account of the favours which he has received. Many connections are formed, and dignified with the name of *friendship*, upon no other principle but the sordid hope which one or perhaps each of the parties entertains of accomplishing some selfish purpose through the assistance of the other: but such a connexion is so base in its nature, and so transitory in its duration, as to render it unnecessary for us to spend time in demonstrating it to be unworthy of the name of friendship. The instinctive affection which a parent entertains for his child, as well as that which the child feels for his parent, seems intended by nature to form an union between the persons thus related to each other: but the union between parents and children, when supported by no other principle but instinct, is different from friendship: it extends no farther than to cause the parent to provide for his child during his helpless years, and the child to look up to his parent for protection and support. We need not mention that appetite which is the foundation of love, and is the provision which nature has made for the continuation of our species. This appetite alone, and unassisted by some nobler principle, cannot give rise to any connexion worthy of an honourable name.

After excluding these principles, we can refer the origin of friendship only to "an opinion entertained by each of the parties between whom it subsists, that the other is adorned with some amiable or respectable qualities." A connexion founded on different principles we cannot honour with the name of friendship; but that which flows from this pure source must be noble and virtuous. When two persons of virtue and abilities contemplate each the other's character and conduct, they cannot but view them with complacency and esteem. Habits and actions displaying prudence, fortitude, moderation, integrity, benevolence, and piety, naturally command the approbation of the impartial spectator, and even affect him with delight. But as we are disposed to revisit a landscape the beauties of which we have contemplated with rapture, and read with frequent delight a poem in which genius has faithfully delineated some of the most enchanting scenes or the most interesting events in nature; so we also become desirous to enjoy frequent opportunities of contemplating a character distinguished for eminent abilities and illustrious virtues. The society of such a person is preferred to his who is disgraced by the opposite qualities. Hence, whenever men of truly respectable characters enjoy opportunities of mutual intercourse, an attachment naturally takes place between them; entirely disinterested, and founded solely on the approbation with which the one cannot avoid regarding the conduct of the other. The esteem which the one is thus induced to entertain for the other will lead them to seek frequent opportunities of enjoying each other's society, mutually to ask and listen to advice, to trust their most secret and important purposes to each other's confidence, and to be no less concerned each of them for the other's interest and honour than for his own. This, and this alone, is genuine friendship; founded on virtue, and on that approbation which virtue never fails to command: it is a natural consequence of intercourse between virtuous men.—Where it is once established, it cannot die, while those virtues to which it owes its origin continue to adorn the persons between whom it subsists.

3
Circumstances favourable to the rise and continuance of friendship.

But, perhaps, such a pure and sublime attachment can scarce be expected to exist among beings of so mixed and imperfect a character as mankind. The wise man of the ancient Stoics, or the Christian who fully obeys the precepts, and follows the steps of his Saviour, might be capable of it; but, unfortunately, humanity never reaches such perfection. Virtue and vice are so blended together in every human character, that while none is so worthless as to excite no other sentiment but abhorrence, there is scarcely any so uniformly virtuous as to command unvaried esteem or admiration. Even the purest and most disinterested of those friendships which prevail among men, owe their origin to other meaner principles, as well as to that which has been mentioned as the principle of genuine friendship. There are certain circumstances favourable, and others adverse, to the formation and continuance of friendship. These, making amends, as it were, for the imperfection of human virtue and human knowledge, lead men to overlook each other's faults and follies, and to unite in the bonds of friendship; a friendship which, though less solid, less generous, and less lasting, than that which we have above described, is yet attended with effects favourable to the happiness of individuals, and to the interests of society in general.

Equality of age is favourable to friendship. Infancy, manhood, and old age, differ so considerably from each other in their views, passions, and pursuits, that the *man* will seldom be disposed to associate with the *boy* or

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or the *youth*, in preference to one who has had equal experience in the world with himself; and the *old man* will generally wish for the company of some ancient friend, with whom he may speak of "the days of former years."

They who cultivate the *same trade or profession*, enjoy opportunities favourable to the formation of friendship. Being engaged among the same objects, and acquiring skill in the same arts, their knowledge, their sentiments, and habits, are nearly the same; they cannot avoid frequent intercourse with each other; they naturally enter into each other's prejudices and views, and therefore cannot but take pleasure in each other's conversation and society. Physicians, lawyers, and divines, form each of them a distinct body; and the members of each of those bodies associate with one another more readily than with men of a different profession. It is related by Swift or Addison, that, in the beginning of the last century, there was a particular coffeehouse in London which clergymen used to frequent, and that a son of the church scarcely ever ventured to show his head in any other. In the days of Dryden, poets, and all who pretended to poetical genius or taste, resorted to *Will's*, as to another Parnassus, to sip cups of coffee, and now and then perhaps to drink of some more inspiring liquor, instead of the waters of the fountain Hippocrene.

Equality of rank and fortune is also favourable to friendship. Seldom will a man of fortune be able to gain the sincere friendship of any of his dependents. Though he treat them with the most obliging condescension, and load them with favours; yet still, either the sense of dependence, or resentment for imaginary injuries, or impatience of the debt of gratitude, or some other similar reason, will be likely to prevent them from regarding him with cordial affection. Servants are but rarely faithful even to the most indulgent master: Shakespeare's old Adam is a very amiable but a very uncommon character. Indeed you may as soon expect to find the virtues and the generous courage of the chevalier Bayard among our military men of the present age, as to find an old Adam among the present race of servants. It is no less vain for the poor man to hope to acquire a sincere friend among his superiors in rank and fortune. The superior is generally disposed to exact such profound deference, such gratitude, such respect, even from the inferior whom he admits into his intimacy, that the equal amicable intercourse of friendship can scarce ever take place between them. Among the letters of the younger Pliny, we are pleased to find many monuments of the goodness of his heart. A number of his epistles addressed to friends in meaner circumstances appear to have been accompanied with very considerable presents, which by his opulence he was well enabled to bestow. But he takes care to let those humble friends know the weight of the obligations which he conferred, and the vastness of the debt of gratitude which they owed to him, in such plain, nay even indelicate terms, that though they might receive his favours with gratitude, and regard him as their benefactor, yet they could never regard him as a man with whom they might cultivate the free easy intercourse of friendship. Some one or other of the Greek writers mentions a singular instance of cordial friendship subsisting between two persons in unequal circumstances. One of them dying before the other, and leaving a wife and daughter to whom he had no fortune nor even means of subsistence to bequeath, enjoined his rich friend, in his will, to take the charge of them on himself, and to support them in a liberal manner: nor did he entreat this from his humanity, but demanded it from his friendship. He had made a sure provision for his family. His rich friend delayed not to comply with his dying injunction. He readily took upon himself the charge of the wife and daughter of his deceased friend, treated them with kindness, and at last divided his whole fortune equally between his own only daughter and the child of his friend. This is an agreeable instance of the power of friendship: but such instances are not to be expected to occur frequently in ordinary life, any more than the Stoic virtue of Cato, or the modest piety of a Nelson.

Similarity of taste and temper will generally be found favourable to friendship. Two peevish men, indeed, will not long endure each other's company with much satisfaction; but two persons of mild, humane dispositions will naturally take delight in each other's society and conversation. They who are charmed with the bustle of a gay and active life, avoid the haunts of the indolent and contemplative, and join hand in hand to climbs the heights of ambition, or tread the round of amusement and dissipation. Those whom taste leads to cultivate the elegant objects of literature amid the sweets of a rural retirement, to wander through the grove, or recline on the brink of some romantic rill, and peruse the pages of one of those geniuses who have shown themselves able to enlighten the understanding, and to kindle the glow of generous sentiment in the breast;—those children of taste frequently associate in their elegant pursuits. We are pleased to read the correspondence of Pliny and Tacitus, of Loeke and Molineaux, of Swift and Pope. We rejoice to find, that nothwithstanding the rivalry of learning and genius, taste and philosophy have a natural tendency to promote benevolence and friendship among their votaries. The bustle of the world must be acknowledged to be generally unfavourable to friendship. When the heart is occupied with the sordid objects of ambition, or avarice, or gay dissipation, there is no room left for the pure and generous sentiments of friendship. Interests often interfere, competitions and jealousies arise, fatal to all the sweets of social intercourse. It is in active life that virtue shines with the most brilliant lustre; but seldom, alas! does pure virtue appear in the scenes of active life. How beautifully does the character of Atticus shine amid the characters of his illustrious cotemporaries! *ut Luna inter minores ignes!* Sylla, Cæsar, Cicero, Brutus, Antony, and Augustus, were eminent for their abilities and virtues; but being engaged in the bustling pursuits of ambition, they seem to have been strangers to the calm and elegant happiness which Atticus enjoyed. Though those of them who were cotemporaries could not avoid perceiving and admiring each other's merits, yet never did cordial friendship subsist between them. Even Cicero, who could so well define the duties and describe the happiness of friendship, yet appears to have but seldom enjoyed its delights. But Atticus, who constantly declined entering the scenes of public life, Friendship. life, experienced such happiness in a private condition, as must have been more than an ample reward to him for shunning all the splendid pursuits of ambition. He was the disinterested friend of all those eminent men, and enjoyed their esteem and friendship. So upright was his character, so amiable his manners, that they who were mortal enemies to each other, yet agreed in cultivating at the same time the friendship of Atticus. None of them appear to have hated him on account of his attachment to their enemies; and while he was the friend of Cicero and Octavius, he was at the same time the protector of the wife of Antony. Perhaps the virtue of such a character may be regarded as problematical. It may be alleged, that while such inveterate dissensions arose among his friends, the neutrality which he preserved was inconsistent with integrity. He has indeed been rashly branded by some writers as an avaricious time-serving man. But no evidence appears to justify their assertions; on the contrary, the most respectable testimony, the nicest scrutiny, exhibit his character in those amiable colours in which we have chosen to view it. Atticus is indeed no ordinary character. The general principles of human nature, and the examples which most frequently occur in the world, naturally suggest a suspicion, that had he been a man of genuine integrity, he must have observed a different tenor of conduct. But there is one circumstance which tends to strengthen considerably the respectable testimony of his cotemporaries in his behalf. In Cato, in Epictetus, in the philosopher, who, while suffering under all the violence of an acute distemper, maintained to Pompey that pain was no evil, we have instances of the tenets of philosophy opposing and repressing the principles of nature. We know how often religious enthusiasm has produced the same effects. But Atticus was the votary of the mild and elegant philosophy of Epicurus; which, though there appears to have been a palpable inconsistency between its principles and the superstructure raised upon them, was yet in its general tendency not unfriendly to virtue, and recommended to its votaries that calm and innocent mode of life which Atticus cultivated. There is no small resemblance between the character of Atticus and that of Epicurus, the founder of this philosophy. The same tenets seem to have produced the same effects on both; and we will venture to pronounce so high an encomium on the Epicurean philosophy, as to assert, that it chiefly contributed to form the character of this amiable Roman.

We know not if we may venture to affirm, that friendships are most naturally contracted among persons of the same sex. We believe they often are. If similarity of taste, of sentiments, of manners, be favourable to friendship, this cannot but happen. The distinction which nature has established between the two sexes, the new distinctions which are introduced by the different views with which their education is conducted, and the different duties which they are called to perform in life, have all a tendency to dispose men and women to enter into habits of intimacy with persons of their own sex rather than with the other. Young girls have their peculiar amusements, as boys have theirs: they knit and sew together, consult each other concerning their dress, and associate at their idle hours. Young men, in the same manner, prefer the society of their equals of the same sex till such time as their hearts begin to feel the impulse of a new passion. This soft passion, indeed, causes the youth to prefer the company of his favourite maid to that of his dearest companion; and it perhaps causes the virgin to view her female companions with a jealous eye, while she fears that their charms may win the heart of the youth, whose fond regard she herself wishes to engage. But the fears, the jealousies, the timidity, nay even the fondness of love, are incompatible with friendship. Though the lover and his mistress be dear to each other, yet the free confidence of friendship cannot take place between them. They dare not yet venture to trust to each other all the secrets of their hearts. But if their mutual wishes be crowned by marriage; then, indeed, as their interests become the same, if the transports of love are not succeeded by the calm delights and the free confidence of friendship, they must be unhappy. The marriage state is peculiarly favourable to friendship. Persons whose relations to each other are the more remote, will often find circumstances concurring to induce them to cultivate a friendly intercourse with each other. But here indifference is almost impossible. It is absolutely requisite, in order that they may not render each other miserable, that the husband and the wife be united in the bonds of friendship. This seems even to be one of the great laws of nature, by means of which provision is made for the happiness and the preservation of society. But though the wife and the husband be particularly attached to each other by the ties of friendship no less than by those of love, yet their mutual affection will not detach them from the rest of the world: their relations to the society around them will still remain; the husband will still cultivate the intimacy of those of his own sex, and the wife will still choose female in preference to male friends. Upon even a superficial view of life, we find reason to declare without hesitation, that acquaintance and intimacy most naturally take place among persons of the same sex. The husband and the wife are more than friends; they are *one bone and one flesh*. It has been sometimes slightly insinuated, and sometimes more openly asserted, by people who have but carelessly viewed the phenomena of social life, or have been disposed to cavil against the fair sex, that women are incapable of sincerity or constancy in friendship with each other. But it seems unnecessary to offer a serious refutation of this cavil. Neither is the general character of the female sex so inferior to that of the male, nor are their circumstances so very different from ours, as to render them totally incapable of those virtues which are necessary to establish and support mutual friendship. They are in general possessed of more exquisite sensibility, nicer delicacy of taste, and a juster sense of propriety, than we: nor are they destitute of generosity, fidelity, and firmness. But such qualities are peculiarly favourable to friendship; they communicate a certain charm to the manners of the person who is adorned with them; they render the heart susceptible of generous disinterested attachment; and they elevate the soul above levity, insincerity, and meanness. Competitions and jealousies must no doubt arise now and then even among the most amiable of the female sex, as well as among us. These will preclude or destroy

 friendship.

Friendship. friendship. But the rivalry of beauty, of dress, of fashion, is not oftener fatal to friendship among the fair sex, than the contests of pride, avarice, vanity, and ambition, among their haughty lords. If friendship be ranked among the virtues, it is not less a female than a male virtue.

5
Relations of consanguinity.

The delightful intercourse and intimacy of friendship may be naturally expected to subsist not only between the husband and the wife, but among all who are connected by any of the relations of consanguinity. The power of instinct does not always continue to unite the parent and the child. Its offices are of a temporary nature; but when these are performed, it ceases to operate. During the infancy, the childhood, and even the youth of his son or daughter, the parent watches over them with fond affection, and labours with anxious assiduity to promote their welfare, for no other reason but because the yearnings of paternal affection draw him towards them. But as they advance farther in life, and become able to care for themselves, it has been so ordered by the wisdom of nature, that the attachment of the parent almost dies away, unless the grateful affection and the merit of his children afford him reason to rejoice over them and bless them. How shocking, how miserable, the condition of that family, whose members are not united by the mutual esteem and confidence of friendship! where the parent views his children with jealousy, shame, indignation, or sorrow: and the children anxiously avoid the society of their parents! Their interests are so nearly connected; they have so many occasions for acting in concert, and must live so long together; that we may almost venture to affirm, that the parent and the child, like the husband and the wife, must be either friends or enemies. But the ties of nature, the influence of habit, sentiments, and circumstances, all concur to form between them the sacred connexion of friendship. Brothers and sisters, the children of the same parents, and for a while members of the same family, may be expected to regard each other through life with kindness and esteem; and these we would rather choose to attribute to a rational attachment, founded on certain principles, than to a blind instinctive affection.

These are a few of the distinctions and relations in society which appear most favourable to friendship.—Were we to descend to minuter particulars, we might enumerate all the varieties of taste, of temper, and of circumstances, by which mankind are distinguished from one another, and distributed into particular classes. But this would be too tedious, and does not appear necessary.

6
Laws of friendship.

As friendship is an attachment which takes place between certain human characters when placed in certain circumstances, there must therefore be laws for supporting the attachment and regulating the intercourse of friendship. Mutual esteem is the basis on which true friendship is established; and the intercourse of friendship ought surely to be conducted in such a manner that this foundation be not injured. Friendship must diminish neither our benevolence nor prudence: it must not seduce us from an honest attention to our private interest, nor contract our social affections.

Sincerity may be considered as the first law of friendship. Artifice and hypocrisy are inimical to all social intercourse. Between the deceitful and the honest, friendship can never subsist. For a while, the one may impose on the other; unsuspicious integrity may not be able to see through the mask under which the hideous features of selfish cunning are veiled; but the deceitful friend must ever be a stranger to the delightful sentiments of genuine friendship. To enjoy these, your virtues must be sincere, your affection for the person whom you call your friend unfeigned; in communicating to each other your sentiments, in offering and listening to mutual advice, in joining to prosecute the same designs, or share in the same amusements, candid sincerity must still be observed between you. Attempt not to persuade each other, that your mutual affection is more ardent, or your mutual esteem more profound, than it really is. If the sentiments or opinions which the one expresses appear to the other improper or ill-founded, let not a false delicacy prevent him from declaring his reasons against them; let him not applaud where, if he were sincere, he must blame. Join not even your friend in an undertaking which you secretly dislike, or an amusement insufferably disagreeable to you. You cannot, consistently with sincerity and candour: and you will soon begin to think the blessings of friendship too dear, when bought at the price of such sacrifices.

But though sincerity is to be faithfully observed in the intercourse of friendship; yet the harshness of contradiction must be carefully avoided. Those obliging manners which are so agreeable in an acquaintance or casual companion, are still more so in a friend. If they are necessary to recommend the advantages of social intercourse in general to the members of society, they are no less necessary to communicate a charm to the intercourse of friendship. People often think themselves entitled to behave to those whom they call their friends, and whose interests they profess to regard as their own, with harshness, negligence, and indiscreet familiarity; but nothing can be more fatal to friendship. It is a well known maxim, established by general and uniform experience, that *too much familiarity occasions mutual contempt*. And indeed how can it be otherwiss? Mild obliging manners are understood as the natural and genuine expression of kindness and affection: boisterous rudeness, petulance, and neglect, are naturally considered as expressive of opposite sentiments. But if friendship assume the tone, the carriage, and the language of enmity or indifference, it must soon lose all its native charms and advantages. Let the friend, as well as the casual companion, when he finds reason to disapprove of the sentiments and conduct, or to dissent from the opinions of his friend, express himself in the gentlest terms, with honesty and sincerity, but without carelessness or harshness. Let no frequency of intercourse nor union of interests ever tempt to careless or contemptuous familiarity. Stiff and unmeaning ceremony may be banished; but ease, and delicacy, and respectful deference, and obliging attention, must supply its room. Much of the unhappiness of the marriage state, and much of the mutual uneasiness which arises among those who are related by the endearing ties of consanguinity, is occasioned by the parties who are thus closely connected, thinking it unnecessary to observe the ordinary rules of good breeding in their mutual intercourse. Even kindness puts

Friendship.

puts on a disgusting garb, and assumes a harsh aspect. But mutual kindness cannot there long subsist. Home, which ought to be a sanctuary to shelter from the anxieties and ills of life, a little paradise where those pure and innocent pleasures might be enjoyed which afford the most genuine happiness, and which are not to be tasted in the bustle of the busy and the dissipation of the gay world; home thus becomes a place of torment, which is never entered but with pain and unwillingness; and from which the son, the daughter, the husband, and the wife, eagerly seize every opportunity to escape.

Mutual confidence is the very soul of friendship. If friendship be rightly defined to be a mutual affection founded on mutual esteem, those who are united in the bonds of friendship cannot but repose mutual confidence in each other. Am I conscious of none hut generous worthy sentiments, and none but upright honest intentions? I readily disclose all the secrets of my soul to him whom I regard as capable only of similar designs and similar sentiments. But it may be asked, how far the confidence of friendship ought to be carried? Must I reveal to my friend all my sentiments, opinions, and designs? Must I communicate to one friend the secrets which have been intrusted to me by another? Or must I rather observe the most suspicious caution in my intercourse with my friends, remembering that he who is now my friend may one day become my enemy? It seems most prudent to observe a medium between suspicious caution and unlimited confidence. Were human virtue perfect, and were there no instances of friends ever becoming enemies, those who regard each other with friendly affection might very reasonably be required to set no bounds to their mutual confidence. But as this is far from being the case, different measnres are to be observed. Contract no friendships, if you think it necessary to treat a friend with the same reserve as an enemy. Yet venture not to disclose to your friend all the foolish or evil designs which the wantonness of imagination máy seduce you to form. When you feel the emotions of pride, of vanity, or of any evil passion, if you are able to repress them by the strength of reason and conscience, it seems unnecessary for you to tell the struggle, or to boast of the victory. If, at any former period of life, you have been so unfortunate as to commit actions which you cannot now recollect without shame and contrition, there can be no reason why you may not, as far as possible, bury the remembrance of them in your own breast. In short, not to become tedious by descending to minute particulars, the laws of friendship do not require friends to unbosom themselves to each other any farther than is necessary—to give them just ideas of each other's character and temper,—to enable them to be serviceable to each other in the prosecution of honest designs,—and to afford each of them proper opportunities of exciting the other to virtue and wisdom, and of interposing his influence to preserve him from vice and folly. Whatever is necessary for any of these purposes ought to be mutually communicated; whatever is not, may be concealed without violating the laws of friendship. As mutual esteem is the foundation of friendship, and as human friendships are not always lasting, you ought not to pour into the ear of your friend all the impertinences which you may happen to conceive, nor even all the projects which may float in your imagination: but as much of the felicity of friendship arises from the mutual confidence to which it affords room, call not any man your friend in whose presence you find it proper to observe the same suspicious caution as if he were your enemy. The ancients, who talked of friendship with enthusiasm as one of the most elevated among the virtues, required a still closer union and a more disinterested attachment among friends than we dare venture to insist upon. The mutual duties which they have described as incumbent on friends, appear somewhat extravagant. Among other things, some of them have gone so far as to require a degree of mutual confidence which would soon destroy all confidence, and could not fail to counteract all the purposes of friendship: they have required one friend to communicate to another, not only all his own thoughts and purposes, but even those secrets which have been confided to his honour by any other friend. But the evil consequences which would result are easily to be foreseen. Perhaps, like Atticus, you enjoy the friendship of men who are mutual enemies; and by communicating the secrets of the one to the other, you will then become the betrayer of both. Or, though not absolutely enemies, yet those who are *your* friends may happen not to be in habits of friendship with each other; and they may then perhaps not scruple to divulge those secrets of one another which you have imprudently blabbed to them. Indeed, might we suppose all mankind absolutely faultless, and not liable to moral imperfection, we need not fear these bad consequences from unbounded confidence in our friends. But friendship would in such a state of society be unknown: just as in the golden age of the poets there are supposed to have been no distinctions of property. We cannot here forbear dropping an observation, which will readily be acknowledged as just by all who have any tolerable knowledge of the morality of the philosophers of ancient Greece. All their doctrines and precepts appear calculated for a different order of beings than mankind. They glanced carelessly at the phenomena of the moral world; and gleaning a few facts, immediately set themselves to erect systems: From these, however wild and theoretical, they then pretended to deduce laws for the regulation of human conduct; and their rules are generally such as might be expected from the means which they appear to have employed in order to arrive at them. An apology has, however, been offered for some of them, which, in our opinion, could occur only to superficial observers of human life. It has been alleged in behalf of the Stoics, that their system indeed required more exalted virtue than human nature is capable of attaining; but that, notwithstanding this, it could not fail to produce the happiest effects on the manners and sentiments of its votaries. Instances, too, have been produced in support of this assertion; a Cato, an Epictetus, an Antoninus. When we contemplate a model of perfection beyond what we can hope to reach, say the advocates of the Stoic philosophy, though we despair of attaining, yet we are prompted to aspire after it. Now, the most natural way of reasoning here seems to lead to a very different conclusion. If an object is set before me which I must not hope to obtain, I am unwilling to waste my time and exhaust

Friendship. exhaust my vigour in the pursuit of it: bid me ascend an inaccessible height, I view the vale below with new fondness. Philosophy, as well as superstition and enthusiasm, might in a few instances triumph over the principles of nature; but was it always equally powerful? Were all the disciples of Zeno Catos or Epictetuses? Have all the monks and anchorites of the Romish church been holy as the founders of their orders? No: The Greek philosophers who infested Rome, and taught those *whimsical* doctrines which we hear frequently dignified with the name *sublime*, were singularly corrupted and licentious in all their manners. If those of the *regular* clergy of the church of Rome have been always more pure, they have been cruelly calumniated. Ask, then, only what I am capable of performing: If you demand what is above my strength, I sit still in indolence. In its general tendency, the Stoic philosophy was favourable rather to vice than to virtue.

But we have not yet exhausted all the duties of friendship. We have inculcated sincerity, and mutual respect and obligingness of manners; we have also endeavoured to ascertain what degree of mutual confidence ought to take place between friends. But an important question still remains to be considered: how far is an *union of interests* to take place between friends? Am I to study the interest of my friend in preference to my own? May I lawfully injure others, in order to serve him? Here, too, we must consider the circumstances and the strength of human nature; and let us beware of imposing burdens too heavy to be borne. The greater and more perfect the union which reigns in society, the greater will be its strength and happiness; the closer the union of friends, the more advantages will each of them derive from their union. Where other ties besides those of friendship concur to unite two individuals, their interests will be more closely conjoined than if they were connected by the ties of friendship alone. The order of nature seems here to be,—the husband and wife—the parent and child—brothers and sisters, the offspring of the same parents—friends, connected by the ties of friendship alone. And, if we may presume to guess at the intentions of the Author of nature from what we behold in his works and read in his word, the closest union in society ought to be that between the husband and the wife; their interests are altogether the same; they ought mutually to forego convenience and gratification for each other's sake. The interests of parents and children are somewhat less closely connected; much is due from the one to the other, but somewhat less than in the former relation; their interests may sometimes be separate, but never ought to be opposite. Next come brethren, and other more distant relations; and next, the friend. In these cases, where we suppose the attachment of friendship to operate together with the ties of nature, we perceive that interests are variously united, and various duties are due; scarcely in any of them does it appear that the interests of two can become entirely one. Still less can that be expected to happen, where the ties of friendship act not in concert with those of nature. We give up, therefore, all those romantic notions, which some have so earnestly insisted on, of requiring the friend to consider his friend as himself. We cannot expect any two individuals to possess precisely the same degree of knowledge, to entertain exactly the same sentiments, or to stand in circumstances precisely similar. But till this happen, the interests of two can never be precisely the same. And we will not, therefore, require the friend actually to prefer his friend to himself; nay, we will even allow him to prefer himself to his friend; convinced that such is the design of nature, and that by presuming to counteract the principles of nature we shall be able to serve no useful purpose. But as far as the first principles of human action and the institutions of society permit, we may reasonably require of friends, that they mutually endeavour to contribute each to the other's interest. You will not desert your own family, nor neglect what is absolutely necessary for your own preservation, in order that you may serve a friend. It is not requisite that you be either a Damon or a Pythias. Away with what is romantic; but scruple not to submit to what is natural and reasonable. When your friend needs your direction and advice, freely and honestly give it: does he need more than advice; your active exertions in his behalf? the laws of friendship require you not to refuse them. Is it necessary for him to receive still more substantial assistance? You may even be expected to aid him with your fortune. But remember, that even the amiable principle of benevolence must be subject to the directions of prudence; if incapable of taking care of ourselves, we cannot be expected to contribute to the good of others; society would not be favourable to the happiness of the human race, if every individual studied the general interest so far as to neglect his own. We are not born to be citizens of the world; but Europeans, Britons, Englishmen or Scotchmen. Let every one, then, seek the interest and happiness of his friends with whom he is connected by the laws of friendship alone, in subordination to his own particular interest and happiness, and to the interest and happiness of those with whom he is connected by the ties of nature and the general institutions of society. Engage not in the service of your friend, nor lavish your fortune in his behalf, if by that means you are likely to injure either yourself or your family. Still less will you think it requisite to carry your friendship to such romantic excess as to commit crimes in the service of your friend. The ancients, whose ideas of the nature and duties of friendship were romantic and extravagant, have, some of them, required that a friend should hesitate at no action, however atrociously wicked, by which he can be useful to his friend. Have I been guilty of theft or murder, or any other heinous violation of the laws of morality or the institutions of society: when I am brought to justice for my crime, if you, being my friend, are appointed to sit as my judge, the laws of friendship, say those admirable masters of morality, require that you pronounce me innocent, though convinced of my guilt. But we need not declaim against the absurdity of enjoining such base deeds as duties of friendship. The idea of a connection, the laws of which are inimical to the order of society, must strike with horror every person who thinks of it. Such a connection is the union of a knot of villains, conspiring against the peace, nay even the existence of society.

7 General view of advantages of friendship.

Such we apprehend to be the nature of rational friendship; such the circumstances in the order of nature

Friendship.

ture and of society which are most favourable to this union; and such the duties, by the performance of which it may be maintained. When founded on these principles, and regulated by these laws, friendship is truly virtuous, and cannot but be highly beneficial to the individuals between whom it subsists, and to the interest of society in general. How delightful to have some person of an amiable and virtuous character in whom you can confide; who will join with you in the prosecution of virtuous designs, or will be ready to call you back when you heedlessly stray into the paths of vice and folly! who will administer to you honest, upright advice; will rejoice in your prosperity, will glory over your virtues, and will be ready to console and relieve you when sinking under the pressure of distress! Must not your connexion with such a person be favourable to your virtue, your interest, and your happiness? When we survey any sublime or beauteous scene in nature, we wish for some person of congenial taste and feelings to participate with us in the noble enjoyments which the prospect affords; when we read any fine piece of composition, the pleasure which we receive from it is more exquisite if others join with us in applauding it. The landscape which we have often surveyed, the poem which we have often read, please us anew, with all the charms of novelty, when we have an opportunity of pointing out their beauties to some person to whom they have been hitherto unknown. Friendship communicates new charms and a more delicate relish to all our most refined and elegant pleasures. It enlivens our joys, it soothes and alleviates our sorrows. What Cicero has said of polite letters and philosophy, may be with still stronger propriety said of friendship. In every condition of life the influence of virtuous friendship is favourable to our welfare and our happiness: in prosperity; in adversity; in the silence and tranquillity of retirement, as well as amid the hurry of business; in the bosom of your family, and when surrounded by your nearest connections, no less than when removed to a strange country. Indeed, whatever advantages society bestows above what are to be enjoyed in a savage state, not less numerous nor less important are those which we may derive from uniting in the bonds of friendship, rather than living in a state of enmity or indifference.

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But though friendship, when founded on mutual esteem, and regulated by the laws of prudence, benevolence, and honesty, be productive of so many happy effects; yet many instances occur in the world, in which connexions dignified with the name of friendship are unfavourable both to the virtue and the happiness of those between whom they subsist. When men associate from views of convenience; when their union is hastily formed without a knowledge of each other's temper and character; when they are drawn together by accident, as when they happen to agree in the pursuits of the same interests or pleasures; when the young and the gay resort together to the haunts of dissipation, and the covetous and ambitious find it convenient to toil in concert for riches and power: on all such occasions, the connexion which is formed and dignified with the name of friendship is unworthy of that honourable appellation. It is not virtuous; it is productive of no happy effects, and is quickly dissolved. He, therefore, who is not incapable of virtuous friendship, and is desirous of enjoying its advantages, must carefully consider the nature of the connexion which he wishes to form, gain a thorough acquaintance with the character of the person whose esteem and affection he wishes to acquire, and attend to those rules by the observance of which true friendship may be maintained.

9
Relation illustrating the power of friendship over the human heart.

Many instances are related, which show what power it is possible for friendship to acquire over the human heart. We need not here repeat the well known story of Damon and Pythias, whose generous friendship afforded a spectacle which softened even the savage heart of Dionysius. It is known to every school-boy; and, after the affecting narrative of Valerius Maximus, has been studiously detailed and commented on by almost every succeeding story-teller or moralist. Addison, in one of his Spectators, gives a beautiful little relation, we know not upon what authority, which finely illustrates the power of both friendship and love. Two male negroes, in one of our West Indian islands, nearly of the same age, and eminent among their fellows in slavery for gracefulness of figure, strength, agility, and dexterity, were also distinguished for their mutual friendship and for their common attachment to a young female negro, who was generally esteemed the most beautiful of her complexion in the whole island. The young female appeared to be equally pleased with both her lovers; and was willing to accept either of them for a husband, provided they could agree between themselves which of them should yield to the pretensions of the other. But here lay the difficulty; for while neither would treacherously supplant, neither of them was willing to yield to his friend. The two youths, therefore, long suffered the severest affliction, while their hearts were torn between love and friendship. At length when they were no longer able to endure the agony of such a contest, being still unable to repress their passion for their lovely countrywoman, and incapable of violating the laws of friendship,—on a certain day, they both, in company with the object of their ill-fated love, retired into a wood adjoining to the scene of their labours. There, after fondly embracing the maid, calling her by a thousand endearing names, and lamenting their own unhappy fate, they stabbed a knife into her breast; which, while still reeking with her blood, was by each of them in his turn plunged into his own. Her cries reached the people who were at work in the next field: some of them hastening to the spot, found her expiring, and the two youths already dead beside her.

We have introduced this little narrative as a striking instance of the noble effects which naturally result from genuine friendship. Here we see it superior to the force of the most violent of passions. Had the elevated souls of those negro youths been refined and enlightened by culture and education in the principles of morality and true religion, we may reasonably suppose that their friendship would have triumphed over their love, without prompting them to the rash and desperate deed which they committed.

10
Not inconsistent with the spirit of Christianity.

Friendship, thus amiable in its character, thus beneficial in its influence and effects, the theme of unbounded panegyric to the philosophers and moralists of every age, has been said by some respectable modern writers to be inconsistent with the spirit of that holy

religion

Friendship.

religion which we profess, and which we regard as the revelation of heaven. General benevolence is frequently inculcated through the gospel: Jesus often earnestly entreated his disciples, "to love one another;" and directed them in what manner to display their mutual love, by telling them that "whatsoever things they could reasonably wish to receive from others, the same ought they to do to them." The writers of the epistles often enlarge on the topics of charity and brotherly love. But private friendship is nowhere recommended in the code of Christianity. Nay, it is so inconsistent with that universal benevolence which the gospel enjoins, that where the one is recommended and enforced, the other may be understood to be tacitly forbidden. But can that religion be true, or can it be favourable to the happiness of its votaries, which is inimical, nay, which is even not friendly to virtuous friendship? Such are the suggestions of Lord Shaftesbury and Soame Jenyns on this head.

We must grant them, that the system of morals or religion which discourages a connection so noble in its origin, so amiable in its character, and so beneficial in its influence, as virtuous friendship, is rather unfavourable to the happiness and virtue of its votaries. But we must consider the genius of Christianity with more careful attention, before we suffer ourselves to be persuaded that friendship is inconsistent with it. Universal benevolence is, indeed, inculcated in the gospel: we are required to love our neighbour as ourselves: and our Saviour seems to insinuate, in the story of the humane Samaritan, that we ought to regard as neighbours all our brethren of the human race, however separated from us by any of the distinctions of society. But it would be unfair to conclude from this, that the great Author of the gospel meant to abolish the order of social life, or to oppose the ties of nature. These may still be respected, though the laws of this benevolence be obeyed. The parent is not required to desert his child, in order that he may assist or relieve his neighbour; nor the child to leave his parent to perish under the infirmities of old age, while he hastens to lend assistance to a stranger. The gospel was not intended to dissolve communities, or to abrogate the distinctions of rank. In Jesus, the end of the ceremonial law was accomplished: by him, therefore, that burden of types and ceremonies with which the Jews had been loaded was taken away. But he who abolished the ceremonial law declared, that the obligations of the moral law should be more permanent than heaven or earth: The duties which it enjoined were still to be religiously discharged: The precepts of the gospel were to illustrate and enforce, not to contradict, the institutions of the moral law. The relative duties of parents and children were still to be performed; though men were directed not to confine all their sentiments of benevolence to domestic relations. Jesus, in his conduct, did not set himself to oppose the order of society. In various parts of the New Testament all the social duties are defined and enforced; the mutual duties of parents and children, of husbands and wives, and of masters and servants. The submission of all the members of a community to that power which is vested with the authority of the whole, is also strictly enjoined in the gospel. Jesus, when in his last moments he recommended his mother to the protection of his beloved disciple, chose to ask *him* to consider *her* as a parent; and directed *her* to expect from *him* the respect and kindness of a son. These facts and observations teach us in what sense to understand that universal benevolence which is inculcated in the gospel. Though we are to love all mankind, yet it is not necessary that all the individuals of the human race share our affection alike. Were we powerful, and wise, and benevolent, as the Deity, such extensive benevolence might be required of us: But our sphere of action and observation is narrow; we cannot extend our acquaintance or influence beyond a very limited circle. Were we to endeavour to be equally useful to all mankind, we should become incapable of being useful to any individual. We cannot become citizens of the world in the sense in which some philosophers have affected to call themselves such, without becoming outcasts from every particular society. A son, a brother, a countryman, a stranger, lie around you, each in circumstances of extreme distress; you pity their misfortunes, and would gladly administer relief; but such is your benevolence, that you feel precisely the same degree of compassion for each of them; you cannot determine to whom you should first stretch out an helping hand; and you therefore stand like that venerable ass of the schoolmen, whose tantalizing situation between two bundles of hay has been so long celebrated and lamented by metaphysicians; and suffer son, and brother, and countryman, and stranger, to perish, without relieving any of them by your kind offices. It is therefore the design of the gospel, that we should submit to the laws of nature, and comply with the institutions of society. First, attend to self-preservation; next, perform the duties of a wife or husband,—a parent,—a child,—a brother,—a citizen,—an individual of the human race. You will do well, indeed, to regard all mankind with benevolence; but your benevolence will be unavailing to the objects of it, if you overlook the distinctions of nature and those institutions which support the union of social life.

But if the spirit of Christianity be not inimical to the institutions and relations of society, neither can it be unfavourable to friendship. If that benevolence which the gospel enjoins admit of any modifications, why not of that particular modification which constitutes private friendship? It is not, indeed, directly enjoined; but neither is it forbidden. It is perfectly consistent with the general tendency and spirit of the gospel system; being favourable to the interests of society, it cannot but be agreeable to our holy religion.

But it is recommended by no direct precept, say those who would represent Christianity as inimical to it; while it has been the favourite theme of the philosophers and moralists of the heathen world.

But why should friendship be recommended by means different from those which the gospel employs for the purpose? Make yourself well acquainted with that admirable system which you so earnestly oppose; you will find that even the duties of private friendship are better explained and more powerfully enforced in the gospel, than by all the heathen philosophers and poets from Hesiod to Plutarch. The gospel makes a distinction between the virtuous and the vicious; it represents one character as more amiable and respectable than another. As it distinguishes between virtue and vice, Friendship. vice, between piety and impiety; so its great object is to deter us from vice, and to encourage us to the practice of virtue. It cannot be supposed, then, that the gospel will direct us to associate indifferently with virtuous and profligate characters. It does not. It directs us to seek improvement, by associating with those whom we have reason to esteem. It directs those who are incorrigibly wicked to be expelled from society. What is this but to command us to enter into habits of intimacy wherever there is ground for mutual esteem? But this is the only basis of genuine friendship. When all the means which lead to a certain end are laid before you, and when you are particularly directed by some high authority to employ those means; though the end which you thus attain be not pointed out, yet the commanding you to employ such a series of means, is evidently the same as if you were directed to accomplish the purpose to which they tend. Thus, though the precepts of Christianity do not directly enjoin private friendship; yet they have a direct tendency to form those exalted characters who alone are capable of true friendship; they inculcate those virtues which naturally give rise to this generous attachment, and are absolutely necessary to support it where it is formed; they inculcate benevolence by the most effectual motives, and admit of modifications of that benevolence, correspondent to the relations and institutions of society: And therefore they may be considered in as strong and direct terms as if it had been expressly said, "Cultivate private friendship." Besides, friendship is rather an *accident* of society, a natural consequence of our character as moral and social beings, than a relation to be regulated and defined by institutions.

Friendship countenanced by our Saviour's example. This union, so natural between virtuous persons, has been countenanced by the example of the Author of our religion; to whose life, no less than to his doctrines and precepts, we will do well to look for a standard by which we may regulate our conduct. We allude to two remarkable instances which occur in the evangelical history; and with the recital of which, as stated in all their striking circumstances by a very elegant writer *, we shall conclude the present article.

"The evangelist, in relating the miracle which Christ performed at Bethany by restoring a person to life who had lain some days in the grave, introduces his narrative by emphatically observing, that 'Jesus loved Lazarus;' intimating, it should seem, that the sentiments which Christ entertained of Lazarus were a distinct and peculiar species of that general benevolence with which he was actuated towards all mankind. Agreeably to this explication of the sacred historian's meaning, when the sisters of Lazarus sent to acquaint Jesus with the state in which their brother lay, they did not even mention his name; but, pointing him out by a more honourable and equally notorious designation, the terms of their message were 'Behold! he whom thou lovest is sick!' Accordingly, when he informs his disciples of the notice he had thus received, his expression is, 'Our friend Lazarus sleepeth.' Now that Christ did not upon this occasion use the word *friend* in its loose undistinguished acceptation, but in a restrained and strictly appropriated sense, is not only manifest from this plain account of the fact itself, but appears farther evident from the sequel. For as he was advancing to the grave, accompanied with the relations of the deceased, he discovered the same emotions of grief as swelled the bosoms of those with whom Lazarus had been most intimately connected; and sympathizing with their common sorrow, he melted into tears. This circumstance was too remarkable to escape particular observation: and it drew from the spectators, what one should think it must necessarily draw from every reader, this natural and obvious reflection, 'Behold! how he loved him!'

"But in the concluding catastrophe of our Saviour's life, he gave a still more decisive proof that sentiments of the strongest personal attachment and friendship were not unworthy of being admitted into his sacred bosom: they were too deeply, indeed, impressed, to be extinguished even by the most excruciating torments. In those dreadful moments, observing among the afflicted witnesses of his painful and ignominious sufferings, that faithful follower who is described by the historian as 'the disciple whom he loved;' he distinguished him by the most convincing instance of superior confidence, esteem, and affection, that ever was exhibited to the admiration of mankind. For, under circumstances of the most agonizing torments, when it might be thought impossible for human nature to retain any other sensibility but that of its own inexpressible sufferings, he recommended to the care and protection of this his tried and approved friend, in terms of peculiar regard and endearment, the most tender and sacred object of his private affections. But no language can represent this pathetic and affecting scene with a force and energy equal to the sublime simplicity of the Evangelist's own narrative: 'Now there stood by the cross of Jesus, his mother and his mother's sister, and Mary Magdalene. When Jesus saw his mother and the disciple (standing) by, whom he loved; he saith to his mother, Behold thy son! then he saith to the disciple, Behold thy mother! And from that hour that disciple took her to his own home.'

"It may safely be asserted, that among all those memorable examples of friendship, which have been celebrated with the highest encomiums by the ancients, there cannot be produced a single instance in which the most distinguished features of exalted amity were so strongly displayed as in the foregoing relation. The only one, perhaps, that bears even a faint similitude to it, is that famous transaction recorded by a Greek author, which passed between Eudamidas and Aretheus. But when the very different circumstances attending the respective examples are duly considered, it must be acknowledged, that the former rises as much above the latter in the proof it exhibits of sublime friendship, as it does in the dignity of the characters concerned.

"Upon the whole, then, it appears, that the divine Founder of the Christian religion, as well by his own example as by the spirit of his moral doctrine, has not only encouraged but consecrated friendship."

Friendship, Friesland. **FRIESLAND**, one of the united provinces of the Low Countries. It is bounded on the east by the river Lauvers, which parts it from the lordship of Groningen, on the south by Overyssel, on the west by the Zuider-Zee, and on the north by the German ocean. It is 30 miles from north to south, and 28 from east to west. The land is very fertile in corn and pasture;

Friesland || Fright.

sture; the horses are large, and the cows and sheep prolific. It is divided into three parts; Westergo to the west, Ostergo to the east, and Sevenwalden to the south. The islands of Sheling, Ameland, and other small ones, are dependent on this province. The principal towns are Leuwarden the capital, Franeker, Dockum, Harlingen, and Staveren.

FRIESLAND, East, a province of Germany, in the circle of Westphalia, lying near the German ocean. It is bounded on the south by the bishopric of Munster, on the east by the country of Oldenburgh, on the west by the province of Groningen, and on the north by the sea, being about 50 miles in length, and 30 in breadth, It belonged to Prussia, but was ceded to Hanover in 1814. It is a very fertile country, and feeds a great number of cattle; but it was greatly damaged by an inundation in 1717, and the repair of the dykes cost an immense sum. The principal towns are Norden, Leer, Essens, Whitmunde, and Aurick. Embden was an imperial city, and the principal place in the country. The inhabitants are Calvinists, with a few Catholics and Baptists.

FRIGATE, in naval affairs, a ship of war usually of two decks, light built, designed for swift sailing. When it hath but one deck, and consequently is of a smaller size, they call her a light frigate.

Frigates mount from 20 to 44 guns, and are esteemed excellent cruisers. The name was formerly known only in the Mediterranean, and applied to a long kind of vessel navigated in that sea with sails and oars. The English were the first who appeared on the ocean with these ships, and equipped them for war as well as for commerce.

FRIGATE-Built, denotes the disposition of the decks of such merchant ships as have a descent of four or five steps from the quarter-deck and forecastle into the waist, in contradistinction to those whose decks are on a continued line for the whole length of the ship, which are called *galley-built*.

FRIGATOON, a Venetian vessel, commonly used in the Adriatic, built with a square stern, and without any foremast, having only a mainmast, mizenmast, and bowsprit.

FRIGHT, or TERROR, a sudden and violent degree of fear. See FEAR.

Sudden fear is frequently productive of very remarkable effects upon the human system. Of this many instances occur in medical writings.—In general, the effects of terror are a contraction of the small vessels and a repulsion of the blood in the large and internal ones; hence proceed a suppression of perspiration, a general oppression, trembling, and anguish of the heart, and lungs overcharged with blood.

Frights often occasion incurable diseases, as epilepsy, stupor, madness, &c. In acute diseases, they have evidently killed many, by the agitation into which they have thrown the spirits, already too much disordered. We have also accounts of persons absolutely killed by terrors when in perfect health at the time of receiving the shock from them: people ordered to be executed, but with private orders for a reprieve, have expired at the block without a wound.—Out of many instances of the fatal effects of fear recorded in writers, the following is selected as one of the most singular. "George Grochantzy, a Polander, who had enlisted as a soldier in the service of the king of Prussia, deserted during the war. A small party was sent in pursuit of him; and when he least expected it, they surprised him singing and dancing among a company of peasants, who were got together in an inn and were making merry. This event, so sudden and unforeseen, and at the same time so dreadful in its consequences, struck him in such a manner, that, giving a great cry, he became at once altogether stupid and insensible, and was seized without the least resistance. They carried him away to Glocau, where he was brought before the council of war, and received sentence as a deserter. He suffered himself to be led and disposed of at the will of those about him, without uttering a word, or giving the least sign that he knew what had happened or would happen to him. He remained immoveable as a statue wherever he was placed, and was wholly passive with respect to all that was done to him or about him. During all the time that he was in custody, he neither ate, nor drank, nor slept, nor had any evacuation. Some of his comrades were sent to see him; after that he was visited by some officers of his corps, and by some priests; but he still continued in the same state, without discovering the least signs of sensibility. Promises, intreaties, and threatenings were equally ineffectual. The physicians who were consulted upon his case, were of opinion, that he was in a state of hopeless idiocy. It was at first suspected that those appearances were feigned; but these suspicions necessarily gave way, when it was known that he took no sustenance, and that the involuntary functions of nature were in great measure suspended. After some time they knocked off his fetters, and left him at liberty to go whither he would. He received his liberty with the same insensibility that he had showed upon other occasions: he remained fixed and immoveable; his eyes turned wildly here and there without taking cognizance of any object, and the muscles of his face were fallen and fixed like those of a dead body. Being left to himself, he passed 20 days in this condition, without eating, drinking, or any evacuation, and died on the 20th day. He had been sometimes heard to fetch deep sighs; and once he rushed with great violence on a soldier, who had a mug of liquor in his hand, forced the mug from him, and having drank the liquor with great eagerness, let the mug drop to the ground."

When a person is affected with terror, the principal endeavour should be to restore the circulation to its due order, to promote perspiration, and to allay the agitation of the patient. For these purposes he may drink a little warm liquor, as camomile tea, &c. the feet and legs may be put into warm water, the legs rubbed, and the camomile tea repeated every six or eight minutes; and when the skin is warm, and there is a tendency to perspiration, sleep may be promoted by a gentle opiate.

But frights have been known not only to cause, but also to cure diseases. Mr Boyle* mentions agues, gout, and sciatica, cured by this means.

* Works Abr. p. &c.

To turn from the serious to the ludicrous effects of fear, the following instance of the latter sort, quoted from a French author by Mr Andrews in his volume of Anecdotes, shows upon what slight occasions this passion may be sometimes excited in a very high degree, even in persons the most unlikely to entertain

Fright ‖ Frilazin.

tain such a guest. "Charles Gustavus (the successor of Christina of Sweden) was besieging Prague, when a boor of most extraordinary visage desired admittance to his tent; and being allowed entrance, offered, by way of amusing the king, to devour a whole hog of one hundred weight in his presence. The old general Konigsmarc, who stood by the king's side, and who, soldier as he was, had not got rid of the prejudices of his childhood, hinted to his royal master that the peasant ought to be burnt as a sorcerer. 'Sir,' said the fellow, irritated at the remark, 'if your majesty will make but that old gentleman take off his sword and his spurs, I will eat him immediately before I begin the hog.' General Konigsmarc (who had, at the head of a body of Swedes, performed wonders against the Austrians, and who was looked upon as one of the bravest men of the age) could not stand this proposal, especially as it was accompanied by a most hideous and preternatural expansion of the frightful peasant's jaws. Without uttering a word, the veteran suddenly turned round, ran out of the court, and thought not himself safe until he had arrived at his quarters; where he remained above twenty-four hours locked up securely, before he had got rid of the panic which had severely affected him."

Fear (Dr Beattie † observes) should not rise higher than to make us attentive and cautious; when it gains an ascendancy in the mind, it becomes an insupportable tyranny, and renders life a burden. The object of fear is evil; and to be exempt from fear, or at least not enslaved to it, gives dignity to our nature, and invigorates all our faculties. Yet there are evils which we ought to fear. Those that arise from ourselves, or which it is in our power to prevent, it would be madness to despise, and audacity not to guard against. External evils, which we cannot prevent, or could not avoid without a breach of duty, it is manly and honourable to bear with fortitude. Insensibility to danger is not fortitude, no more than the incapacity of feeling pain can be called patience; and to expose ourselves unnecessarily to evil is worse than folly, and very blameable presumption. It is commonly called *fool-hardiness;* that is, such a degree of hardiness or boldness as none but fools are capable of. See the article FORTITUDE.

† Elements of Moral Science.

FRIGID (*frigidus*), in a general sense, denotes the quality of being cold. It is frequently applied to a jejune style, that is unanimated by any ornaments, and consequently without any force or vigour.

FRIGID-zone. See ZONE, GEOGRAPHY *Index*.

FRIGIDITY, in *Medicine*, the same with IMPOTENCE.

FRIGORIFIC, in *Physiology*, small particles of matter, which, according to Gassendus and others, being actually and essentially cold, and penetrating other bodies, produce in them that quality which is called *cold*, or, according to others, merely the absence or diminution of the particles of heat. See COLD, CHEMISTRY *Index;* and SALTS.

FRILAZIN, the name of a class or rank of people among the Anglo-Saxons, consisting of those who had been slaves, but had either purchased, or by some other means obtained, their liberty. Though these were in reality free men, they were not considered as of the same rank and dignity with those who had been born free, but were still in a more ignoble and dependent condition, either on their former masters or on some new patrons. This custom the Anglo-Saxons seem to have derived from their ancestors in Germany, among whom those who had been made free did not differ much in point of dignity or importance in the state from those who continued in servitude. This distinction between those who had been made free and those who enjoy freedom by descent from a long race of free men, still prevails in many parts of Germany; and particularly in the original seats of the Anglo-Saxons. Many of the inhabitants of towns and cities in England, in this period, seem to have been of this class of men, who were in a kind of middle state between slaves and freemen.

Frilazin ‖ Frit.

FRILL, in *Falconry*. When a hawk trembles or shivers, they say she frills.

FRINGILLA, a genus of birds belonging to the order of passeres. See ORNITHOLOGY *Index*.

FRIO, a small island on the coast of the Brasils, situated in 32° 2′ S. Lat. and 41° 31′ 45″ W. Long. The land of Frio is high, with a hollow in the middle, which gives it, at a distance, the appearance of two separate islands.

FRIPPERY, a French term sometimes used in our language to signify the trade or traffic of old second-hand clothes and goods. The word is also used for the place where such sort of commerce is carried on, and even for the commodities themselves. The company of frippiers, or fripperers, at Paris, are a regular corporation, of an ancient standing, and make a considerable figure in that city.

FRISI, PAUL, an eminent Italian mathematician. See SUPPLEMENT.

FRISII, FRISEI, FRISIONES, and FRISONES, in *Ancient Geography*, a people of Germany, so called either from their ardent love of freedom, or from the fresh and unbroken lands they occupied, contradistinguished from the old lands. Tacitus divides them, from their extent of power and territory, into the Majores, situated on the coasts between the Rhine and the Ems; and into the Minores, occupying the parts about the lakes lying between the channels of the Rhine.

FRIT, or FRITT, in the glass manufacture, is the matter or ingredients whereof glass is to be made, when they have been calcined or baked in a furnace.

A salt drawn from the ashes of the plant kali, or from fern or other plants, mixed with sand or flint, and baked together, makes an opaque mass called by glassmen *frit;* probably from the Italian *frittare*, to fry; or because the frit, when melted, runs into lumps, like fritters, called by the Italians *fritelli*.

Frit, by the ancients, was called *ammonitrum*, of *αμμος, sand*, and *νιτρον, nitre;* under which name it is described by Pliny thus: Fine sand from the Volturnian sea, mixed with three times the quantity of nitre, and melted, makes a mass called *ammonitrum;* which being rebaked makes pure glass.

Frit, Neri observes, is only the calx of the materials which make glass; which, though they might be melted, and glass be made, without thus calcining them, yet it would take up much more time. Thus calcining, or making of frit, serves to mix and incorporate the materials

terials together, and to evaporate all the superfluous humidity. The frit, once made, is readily fused, and turned into glass.

There are three kinds of frits. The first, crystal frit, or that for crystal metal, is made with salt of pulverine and sand. The second and ordinary frit, is made of the bare ashes of pulverine or barilla, without extracting the salt from them. This makes the ordinary white or crystal metal. The third is frit for green glasses, made of common ashes, without any preparation. This last frit will require ten or twelve hours baking.

The materials in each are to be finely powdered, washed, and searced; then equally mixed, and frequently stirred together in the melting pot. See Glass.

FRITILLARIA, Fritillary; a genus of plants belonging to the hexandria class; and in the natural method ranking under the 10th order, *Coronariæ*. See Botany *Index*.

The different species of fritillary were, according to Beckman, introduced into gardens about the middle of the 16th century. The crown imperial (*fritillaria imperialis*) is supposed by some to be the lily which is much celebrated in sacred scripture; because a figure resembling this splendid plant, they imagine, is found represented on the coins of Herod. Invent. vol. iii.

FRIULI, a province of Italy, subject to Austria, and bounded by Carinthia in Germany on the north, by Carniola on the east, by the gulf of Venice on the south, and by the Bellunese and Feltrin on the west.

FRIZE, or Frieze, in *Architecture*, a part of the entablature of columns, more usually written and pronounced *freeze*. See Freeze.

Frize, or Freeze, in *Commerce*, a kind of woollen cloth or stuff for winter wear, being frized or knapt on one side; whence, in all probability, it derives its name.

Of frizes, some are crossed, others not crossed; the former are chiefly of English manufacture, the latter of Irish.

FRIZING of Cloth, a term in the woollen manufactory, applied to the forming of the nap of cloth or stuff into a number of little hard burrs or prominences, covering almost the whole ground thereof.

Some cloths are only frized on the back side, as black cloths; others on the right side, as coloured and mixed cloths, rateens, bays, freezes, &c.

Frizing may be performed two ways. One with the hand, that is, by means of two workmen, who conduct a kind of plank that serves for a frizing instrument. The other is by a mill, worked either by water, or a horse, or sometimes by men. This latter is esteemed the better way of frizing, by reason the motion being uniform and regular, the little knobs of the frizing are formed more equably and regularly. The structure of this useful machine is as follows:

The three principal parts are the frizer or crisper, the frizing table, and the drawer or beam. The two first are two equal planks or boards, each about 10 feet long and 15 inches broad; differing only in this, that the frizing table is lined or covered with a kind of coarse woollen stuff, of a rough sturdy nap; and the frizer is incrusted with a kind of cement composed of glue, gum arabic, and a yellow sand, with a little aqua-vitæ, or urine. The beam or drawer, thus called, because it draws the stuff from between the frizer and the frizing table, is a wooden roller, beset all over with little, fine, short points or ends of wire, like those of cards used in carding wool.

The disposition and use of the machine is thus: The table stands immoveable, and bears or sustains the cloth to be frized, which is laid with that side uppermost on which the nap is to be raised; over the table is placed the frizer, at such a distance from it as to give room for the stuff to be passed between them; so that the frizer, having a very slow perpendicular motion, meeting the long hairs or naps of the cloth, twists and rolls them into little knobs or burrs; while at the same time, the drawer, which is continually turning, draws away the stuff from under the frizer, and winds it over its own points.

All that the workman has to do while the machine is a-going, is to stretch the stuff on the table as fast as the drawer takes it off, and from time to time to take off the stuff from the points of the drawer.

The design of having the frizing table lined with stuff of a short, stiff, stubby nap, is that it may detain the cloth between the table and the frizer long enough for the grain to be formed, that the drawer may not take it away too readily, which must otherwise be the case, as it is not held by any thing at the other end. It were unnecessary to say any thing particular of the manner of frizing stuffs with the hand, it being the aim of the workmen to imitate, as near as they can with their wooden instrument, the slow, equable, and circular motion of the machine: it needs only be added, that their frizer is but about two feet long and one broad; and that to form the nap more easily, they moisten the surface of the stuff lightly, with water mingled with whites of eggs or honey.

FROBENIUS, John, a famous and learned printer in the 16th century, was born at Hamelburgh in Franconia, and settled at Basil. He had before studied in that university, where he acquired the reputation of being uncommonly learned; and now setting up a printing house in that city, was the first of the German printers who brought that admirable art to any degree of perfection. Being a man of great probity and piety, as well as skill, he was particularly choice in the authors he printed; and would never, for the sake of profit, suffer libels, or any thing that might hurt the reputation of another, to go through his press. The great character of this printer was the principal motive which induced Erasmus to reside at Basil, in order to have his own works printed by him. A great number of valuable authors were printed by Frobenius, with great care and accuracy; among which were the works of St Jerome, Augustine, and Erasmus. He designed to have printed the Greek Fathers; but died in 1527, before he could execute his design. Erasmus wrote his epitaph in Greek and Latin.

John Frobenius left a son named *Jerome Frobenius*, and a daughter married to Nicholas Episcopius; who, joining in partnership, continued Frobenius's printing house with reputation, and printed correct editions of the Greek Fathers.

FROBISHER, or Forbisher, Sir Martin, an excellent navigator and sea officer in the 16th century, was born near Doncaster in Yorkshire, and was from his

his youth brought up to navigation. He was the first Englishman who attempted to find a north-west passage to China, and in 1576 he sailed with two barks and a pinnace in order to attempt that passage. In this voyage he discovered a cape, to which he gave the name of *Queen Elizabeth's Foreland*, and the next day discovered a strait to which he gave his own name. This voyage proving unsuccessful, he attempted the same passage in 1577; but discovering some ore in an island, and his commission directing him in this voyage only to search for ore, and to leave the farther discovery of the north-west to another time, he returned to England. He sailed again, with 15 ships and a great number of adventurers, to form a settlement: but being obstructed by the ice, and driven out to sea by a violent storm, they, after encountering many difficulties, returned home, without making any settlement, but brought a large quantity of ore.—He afterwards commanded the Aid in Sir Francis Drake's expedition to the West Indies, in which St Domingo in Hispaniola, Carthagena, and Santa Justina, in Florida, were taken and sacked. In 1588, he bravely exerted himself in defence of his country against the Spanish armada, when he commanded the Triumph, one of the largest ships in that service; and, as a reward for his distinguished bravery, received the honour of knighthood from the lord high admiral at sea. He afterwards commanded a squadron which was ordered to cruise on the Spanish coast; and, in 1592, took two valuable ships and a rich carrack. In 1594 he was sent to the assistance of Henry IV. king of France against a body of the Leaguers and Spaniards, who had strongly entrenched themselves at Croyzon near Brest; but in an assault upon that fort, on the 7th of November, Sir Martin was unfortunately wounded with a ball, of which he died soon after he had brought back the fleet to Plymouth, and was buried in that town.

Frobisher's Straits, lie a little to the northward of Cape Farewell in West Greenland, and were discovered by Sir Martin Frobisher. W. Long. 48. 16. N. Lat. 63. 12.

FRODSHAM, a town of Cheshire in England, 162 miles from London, is noted for its ancient castle. It has a stone bridge over the river Weaver near its conflux with the Mersey, and a harbour for ships of good burden. By means of inland navigation, it has communication with the rivers 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, Stafford, Warwick, Leicester, Oxford, Worcester, &c.

FROG. See Rana. } Erpetology *Index*.
Bull Frog. See Rana. }

Frog Fish of Surinam, a very singular animal, of which a figure is given by Mr Edwards, *Hist. of Birds*, vol. i. There is no specimen in the British museum, nor in any private collection, except that of Dr Fothergill. It was brought from Surinam in South America. Frogs, both in Asia and Africa, according to Merian, change gradually from fishes to frogs, as those in Europe; but after many years revert again into fishes, though the manner of their change has never been investigated. In Surinam these fishes are called *jakjés*. They are cartilaginous, of a substance like our mustela, and exquisite food: they are formed with regular vertebræ, and small bones all over the body divided into equal parts; are first darkish, and then gray: their scales make a beautiful appearance. Whether this animal is, in its perfect state, a species of frog with a tail, or a kind of water lizard, Mr Edwards does not pretend to determine; but observes, that when its size is considered, it should be deemed a tadpole at first produced from spawn, and in its progress towards a frog, such an animal, when full grown, if it bears the same proportion to its tadpole as those in Europe do, must be of enormous size; for our full grown frogs exceed the tadpoles at least 50 times. See Erpetology *Index*.

FROME, a river that rises from several springs in the western parts of Dorsetshire in England, the principal of which is near Evershot; and directing its course almost due west, passes under Frampton bridge, washes the town of Dorchester, and falls into a bay of the English channel called *Poolhaven*, near Wareham.

Frome-Selwood, a town of Somersetshire in England, 150 miles from London. It is the chief town of this part of the country, which was anciently one great forest called *Selwoodshire*; and in the latter end of the last century, in those called *Frome Woodlands*, there was a considerable gang of money coiners or clippers, of whom many were taken and executed, and their covert laid open. Though the town is bigger than some cities, yet it has only one church; but it has six or seven meeting houses of Protestant dissenters. The inhabitants amounted to 9493 in 1811, and their chief manufactory is broad cloth. About 50 years ago, more wire cards for carding the wool for the spinners were made at this place than in all England besides, which was for the most part supplied with them from hence; for here were no less than 20 master cardmakers, one of whom employed 400 men, women, and children, in that manufactory, at one time; so that even children of 7 or 8 years of age could earn half-a-crown a-week. The river here, which abounds with trout, eels, &c. rises in the woodlands; and runs under its stone bridge towards Bath, on the east side of which it falls into the Avon. This town has been a long time noted for its fine beer, which they keep to a great age, and is generally preferred by the gentry to the wines of France and Portugal. It was governed formerly by a bailiff, and now by two constables of the hundreds of Frome, chosen at the court leet of the lord of the manor.

FRONDESCENTIA, from *frons*, "a leaf;" the precise time of the year and month in which each species of plants unfolds its first leaves.

All plants produce new leaves every year; but all do not renew them at the same time. Among woody plants, the elder, and most of the honeysuckles; among perennial herbs, the crocus or tulip, are the first that push or expand their leaves. The time of sowing the seeds decides with respect to annuals. The oak and ash are constantly the latest in pushing their leaves: the greatest number unfold them in spring; the mosses and firs in winter. These striking differences with respect to so capital a circumstance in plants as that of unfolding their leaves, seem to indicate that each species of plants has a temperature proper or peculiar to itself, and requires a certain degree of heat to extricate the leaves from their buds, and produce the appearance in question.

This temperature, however, is not so fixed or constant as it may appear to a superficial observer. Among plants of the same species, there are some more early than others; whether that circumstance depends, as it most commonly does, on the nature of the plants, or is owing to differences in heat, exposure, and soil. In general, it may be affirmed, that small and young trees are always earlier than larger or old ones.

The pushing of the leaves is likewise accelerated or retarded according to the temperature of the season; that is, according as the sun is sooner or later in dispensing that certain degree of heat which is suitable to each species.

FRONT, the forehead, or that part of the face above the eyebrows. The word is formed of the Latin *frons;* and that from the Greek φρονειν, "to think, perceive;" of φρην, *mens*, "the mind, thought." Martinius, to make out this etymology, observes, that from the forehead of a person we perceive what he is, what he is capable of, and what he thinks of.

FRONT is also used where several persons or things are ranged side by side, and show their front or fore parts.

FRONT, in *Architecture*, denotes the principal face or side of a building, or that presented to their chief aspect or view.

FRONTAL, in *Architecture*, a little fronton or pediment, sometimes placed over a small door or window.

FRONTAL, *Frontlet*, or *Brow-band*, is also used in speaking of the Jewish ceremonies. This frontal consists of four several pieces of vellum, on each whereof is written some text of scripture. They are all laid on a piece of a black calf's leather with thongs to tie it by. The Jews apply the leather with the vellum on their foreheads in the synagogue, and tie it round the head with the thongs.

FRONTIER, the border, confine, or extreme, of a kingdom or province, which the enemies find in front when they would enter the same. Thus we say, a frontier town, frontier province, &c. Frontiers were anciently called *marches*.

The word is derived from the French *frontiere*, and that from the Latin *frontaria;* as being a kind of front opposed to the enemy. Skinner derives *frontier* from *front;* inasmuch as the frontier is the exterior and most advanced part of a state, as the front is that of the face of a man.

FRONTIGNIAC WINE, is so called from a town of Languedoc in France, situated 16 miles south-west of Montpelier, remarkable for producing it.

FRONTINAC, a fortress in Canada, situated at the head of a fine harbour, on the north-west side of the outlet of Lake Ontario, where vessels of every description may ride in perfect safety. It is 300 miles from Quebec, and in comparison of that place has a very short winter.

FRONTINUS, SEXTUS JULIUS, an ancient Roman writer, was of consular dignity, and flourished under the emperors Vespasian, Titus, Domitian, Nerva, and Trajan. He commanded the Roman armies in Britain; was made city prætor when Vespasian and Titus were consuls; and Nerva made him curator of the aqueducts, which occasioned his writing *De Aquæductibus urbis Romæ*. He wrote four books upon the Greek and Roman art of war; a piece *De Re Agraria*, and another *De Limitibus*. These have been often separately reprinted; but were all collected together in a neat edition at Amsterdam in 1661, with notes by Robertus Keuchenius. He died under Trajan.

FRONTISPIECE, in *Architecture*, the principal face of a fine building. The word is formed of the Latin *frontispicium*, q. d. *frontis hominis inspectio*. Hence also, by a figure, we say, the frontispiece of a book; meaning an ornament with an engraven title on the first page.

FRONTLET. See FRONTAL.

FRONTO, MARCUS CORNELIUS, was chosen for his eloquence to instruct the emperors Marcus Aurelius and Lucius Verus in rhetoric; in recompense of which he was promoted to the consulate, and a statue was erected to his honour. He taught Marcus Aurelius not only eloquence, but the duty of kings, and excellent morals. Some say he wrote against the Christians. A sect was formed of those who looked upon him as a model of perfect eloquence, and those were called *Frontoniani*. The Civilians, whose names were *Fronto*, mentioned in the Pandects, were probably descended from him.

FROST, in *Physiology*, such a state of the atmosphere as occasions the congelation or freezing of water and other fluids. See COLD, CHEMISTRY *Index*, and METEOROLOGY *Index*.

Water and other fluids are capable of containing the element of fire or heat in two very different states. In the one, they seem to imbibe the fire in such a manner, that it eludes all the methods by which we are accustomed to observe it, either by our sensation of feeling, or the thermometer; in the other, it manifests itself obviously to our senses, either by the touch, the thermometer, or the emission of light.

In the first of these states, we call the body *cold;* and are apt to say that this coldness is occasioned by the *absence* of heat. But this manner of expressing ourselves, excepting in a relative degree, is certainly improper; for even those fluids which are coldest to the touch contain a vast deal of heat. Thus vapour, which is colder to the touch than the water from which it was raised, contains an immense quantity of fire, even more than sufficient to heat it red hot. The like may be said of common salt and snow, or ice. If a quantity of each of these substances is separately reduced to the degree of 28 or 30 of Fahrenheit's thermometer, upon mixing them together, the heat which would have raised the thermometer to the degree above mentioned, now enters into the substance of them in such a manner that the mercury falls down to 0.—Here an excessive degree of cold is produced, and yet we are sure that the substances contain the very same quantity of heat that they formerly did: nay, they will even seem exceedingly cold, when they must certainly contain a great deal more heat than they originally did; for they absorb it from all bodies around them; and if a small vessel full of water is put into the middle of such a mixture, it will in a short time be full of ice.

It appears, therefore, that our senses, even when assisted by thermometers, can only judge of the state in which the element of fire is with relation to the bodies

dies around us, without regard to the quantity contained in them. Thus, if heat flows from any part of our body into any substance actually in contact with it, the sensation of cold is excited, and we call that substance *cold;* but if it flows from any substance into our body, the sensation of heat is excited, and we call that substance *hot*, without regard to the absolute quantity contained in either case.

Of all known substances, the atmosphere either absorbs or throws out heat with the most remarkable facility: and in one or other of these states it always is with respect to the surface of the earth, and such bodies as are placed on or near it; for these, properly speaking, have no temperature of their own, but are entirely regulated by that of the atmosphere.—When the air has been for some time absorbing the heat from terrestrial bodies, a frost must be the undoubted consequence, for the same reason that water freezes in a vessel put into a freezing mixture; and were this absorption to continue for a length of time, the whole earth would be converted into a frozen mass. There are, however, certain powers in nature, by which this effect is always prevented; and the most violent frost we can imagine, must always as it were defeat its own purposes, and end in a thaw. To understand this subject, we must observe,

1. In that state of the atmosphere which we denominate frost, there is a most intimate union between the air and the water it contains; and therefore frosty weather, except in very high latitudes, is generally clear.

2. When such a union takes place, either in winter or summer, we observe the atmosphere also inclined to absorb heat, and consequently to frost. Thus in clear settled weather, even in summer, though the day may be excessively hot by reason of the continued sunshine, yet the mornings and evenings are remarkably cold, and sometimes even disagreeably so.

3. The air being therefore always ready in the time of frost or in clear weather, to absorb heat from every substance which comes into contact with it, it follows that it must also absorb part of that which belongs to the vapours contained in it.

4. Though vapour is capable of becoming much colder than water without being frozen, yet by a continued absorption it must at last part with its latent heat, i. e. that which essentially constitutes its vapour, and without which it is no longer vapour, but water or ice. No sooner, therefore, does the frost arrive at a certain pitch, than the vapours, everywhere dispersed through the air, give out their latent heat: the atmosphere then becomes clouded: the frost either totally goes off, or becomes milder by reason of the great quantity of heat discharged into the air; and the vapours descend in rain, hail, or snow, according to the particular disposition of the atmosphere at the time.

5. Even in the polar regions, where it may be thought that the frost must increase beyond measure, there are also natural means for preventing its running to extremes. The principal cause here is, the mixture of a great quantity of vapours from the more temperate regions of the globe with the air in those dreary climates. It is well known, that aqueous vapour always flies from a warm to a colder place. For this reason, the vapours raised by the sun in the more temperate regions of the earth, must continually travel northward and southward in great quantities. Thus they furnish materials for those immense quantities of snow and ice which are to be found in the neighbourhood of the poles, and which we cannot imagine the weak influence of the sun in these parts capable of raising. It is impossible that a quantity of vapour can be mixed with frosty air, without communicating a great deal of heat to it; and thus there are often thaws of considerable duration even in those climates where, from the little influence of the sun, we should suppose the frost would be perpetual.

Frost.

6. We may now account with some probability for the uncertain duration of frosts. In this country they are seldom of a long continuance; because the vapours raised from the sea with which our island is surrounded, perpetually mix with the air over the island, and prevent a long duration of the frost. For the same reason, frosts are never of such long duration in maritime places on the continent, as in the inland ones. There is nothing, however, more uncertain than the motion of the vapours with which the air is constantly filled; and therefore it is impossible to prognosticate the duration of a frost with any degree of certainty. In general, we may always be certain, that if a quantity of vapour is accumulated in any place, no intense frost can subsist in that place for any length of time; and by whatever causes the vapours are driven from place to place, by the same causes the frosts are regulated throughout the the whole world.

The effects of frost in different countries are enumerated under the article CONGELATION. In the northern parts of the world even solid bodies are liable to be affected by frost. Timber is often apparently frozen, and rendered exceedingly difficult to saw. Marl, chalk, and other less solid terrestrial concretions will be shattered by strong and durable frosts. Metals are contracted by frost: thus, an iron tube, 12 feet long, upon being exposed to the air in a frosty night, lost two lines of its length. On the contrary, frost swells or dilates water near one-tenth of its bulk. Mr Boyle made several experiments with metalline vessels, exceedingly thick and strong; which being filled with water, close stopped, and exposed to the cold, burst by the expansion of the frozen fluid within them. Trees are frequently destroyed by frost, as if burnt up by the most excessive heat; and in very strong frosts, walnut trees, ashes, and even oaks, are sometimes split and cleft, so as to be seen through, and this with a terrible noise, like the explosion of firearms.

Frost naturally proceeds from the upper parts of bodies downwards: but how deep it will reach in earth or water, is not easily known; because this depth may vary with the degree of coldness in the air, by a longer or shorter duration of the frost, the texture of the earth, the nature of the juices wherewith it is impregnated, the constitution of its more internal parts as to heat and cold, the nature of its effluvia, &c. Mr Boyle, in order to ascertain this depth, after four nights of hard frost, dug in an orchard, where the ground was level and bare, and found the frost had scarce reached three inches and a half, and in a garden nearer the house only two inches below the surface.

Nine

Frost. Nine or ten successive frosty nights froze the bare ground in the garden six inches and a half deep; and in the orchard, where a wall sheltered it from the south sun, to the depth of eight inches and a half. He also dug in an orchard, near a wall, about a week afterwards, and found the frost to have penetrated to the depth of 14 inches. In a garden at Moscow, the frost in a hard season only penetrates to two feet: and the utmost effect that Captain James mentions the cold to have had upon the ground of Charlton island, was to freeze it to 10 feet deep: whence may appear the different degrees of cold of that island and Russia. And as to the freezing of water at the above-mentioned island, the Captain tells us it does not naturally congeal above the depth of six feet, the rest being by accident. Water also, exposed to the cold air in large vessels, always freezes first at the upper surface, the ice gradually increasing and thickening downwards; for which reason, frogs retire in frosty weather to the bottom of ditches; and it is said, that shoals of fish retire in winter to those depths of the sea and rivers where they are not to be found in summer. Water, like the earth, seems not disposed to receive any very intense degree of cold at a considerable depth or distance from the air. The vast masses of ice found in the northern seas being only many flakes and fragments, which, sliding under each other, are, by the congelation of the intercepted water, cemented together.

In cold countries, the frost often proves fatal to mankind; not only producing gangrenes, but even death itself. Those who die of it have their hands and feet first seized, till they grow past feeling it; after which the rest of their bodies is so invaded, that they are taken with a drowsiness, which, if indulged, they awake no more, but die insensibly. But there is another way whereby it proves mortal, viz. by freezing the abdomen and viscera, which on dissection are found to be mortified and black.

The great power of frost on vegetables is a thing sufficiently known; but the differences between the frosts of a severe winter, and those which happen in the spring mornings, in their effects on plants and trees, were never perfectly explained, till by Mess. Du Hamel and Buffon in the Memoirs of the Paris Academy.

The frosts of severe winters are much more terrible than those of the spring, as they bring on a privation of all the products of the tenderer part of the vegetable world; but then they are not frequent, such winters happening perhaps but once in an age; and the frosts of the spring are in reality greater injuries to us than these, as they are every year repeated.

In regard to trees, the great difference is this, that the frosts of severe winters affect even their wood, their trunks and large branches; whereas those of the spring have only power to hurt the buds.

The winter frosts happening at a time when most of the trees in our woods and gardens have neither leaves, flowers, nor fruits upon them, and have their buds so hard as to be proof against slight injuries of weather, especially if the preceding summer has not been too wet; in this state, if there are no unlucky circumstances attending, the generality of trees bear moderate winters very well; but hard frosts, which happen late in the winter, cause very great injuries even to those trees which they do not utterly destroy. These are, 1. Long cracks following the direction of the fibres. 2. Parcels of dead wood enclosed round with wood yet in a living state. And, 3, That distemperature which the foresters call the *double blea*, which is a perfect circle of blea, or soft white wood, which when the tree is afterwards felled, is found covered by a circle of hard and solid wood.

The opinions of authors about the exposition of trees to the different quarters, have been very different, and most of them grounded on no rational foundation. Many are of opinion that the effects of frost are most violently felt on those trees which are exposed to the north; and others think the south or the west the most strongly affected by them. There is no doubt but the north exposure is subject to the greatest cold. It does not, however, follow from this, that the injury must be always greatest on the trees exposed to the north in frosts: on the contrary, there are abundant proofs that it is on the south side that trees are generally more injured by frost: and it is plain from repeated experiments, that there are particular accidents, under which a more moderate frost may do more injury to vegetables, than the most severe one which happens to them under more favourable circumstances.

It is plain from the accounts of the injuries trees received by the frosts in 1709, that the greatest of all were owing to repeated false thaws, succeeded by repeated new frosts. But the frosts of the spring season furnish abundantly more numerous examples of this truth; and some experiments made by the Count de Buffon at large in his own woods, prove incontestably, that it is not the severest cold or most fixed frost that does the greatest injury to vegetables.

This is an observation directly opposite to the common opinion; yet is not the less true, nor is it in any way discordant to reason. We find by a number of experiments, that humidity is the thing that makes frost fatal to vegetables; and therefore every thing that can occasion humidity in them, exposes them to these injuries, and every thing that can prevent or take off an over proportion of humidity in them, every thing that can dry them though with ever so increased a cold, must prevent or preserve them from those injuries. Numerous experiments and observations tend to prove this. It is well known that vegetables always feel the frost very severely in low places where there are fogs. The plants which stand by a river side are frequently found destroyed by the spring and autumnal frosts, while those of the same species which stand in a drier place, suffer little or perhaps none at all by them; and the low and wet parts of forests are well known to produce worse wood than the high and drier. The coppice wood in wet and low parts of common woods, though it push out more vigorously at first than that of other places, yet never comes to so good a growth; for the frost of the spring killing these early top shoots, obliges the lower part of the trees to throw out lateral branches: and the same thing happens in a greater or lesser degree to the coppice wood that grows under cover of larger trees in great forests; for here the vapours not being carried off either by the sun or wind, stagnate and freeze, and in the same manner destroy the young shoots, as the fogs of marshy places. It

It is a general observation also, that the frost is never hurtful to the late shoots of the vine, or to the flower-buds of trees, except when it follows heavy dews, or a long rainy season, and then it never fails to do great mischief, though it be ever so slight.

The frost is always observed to be more mischievous in its consequences on newly cultivated ground than in other places; and this is because the vapours which continually arise from the earth, find an easier passage from those places than from others. Trees also which have been newly cut, suffer more than others by the spring frosts, which is owing to their shooting out more vigorously.

Frosts also do more damage on light and sandy grounds, than on the tougher and firmer soils, supposing both equally dry; and this seems partly owing to their being more early in their productions, and partly to their lax texture suffering a greater quantity of vapours to transpire.

It also has been frequently observed, that the side-shoots of trees are more subject to perish by the spring frosts than those from the top; and M. Buffon, who examined into this with great accuracy, always found the effects of the spring frosts much greater near the ground than elsewhere. The shoots within a foot of the ground quickly perished by them; those which stood at two or three feet high, bore them much better; and those at four feet and upwards frequently remained wholly unhurt; while the lower ones were entirely destroyed.

There is a series of observations, which have proved beyond all doubt, that it is not the hard frosts which so much hurt plants, as those frosts, though less severe, which happen when they are full of moisture; and this clearly explains the account of all the great damages done by the severe frosts being on the south side of the trees which are affected by them, though that side has been plainly all the while less cold than the north. Great damage is also done to the western sides of trees and plantations, when after a rain with a west wind the wind shifts to the north at sunset, as is frequently the case in spring, or when an east wind blows upon a thick fog before sunrising.

Frost, it is well known, is particularly destructive to the blossom of fruit trees. The following method of securing such trees from being damaged by early frosts may be acceptable to many of our readers. A rope is to be interwoven among the branches of the tree, and one end of it brought down so as to be immersed in a bucket of water. The rope, it is said, will act as a conductor, and convey the effects of the frost from the tree to the water. This idea is not new, for the following passage may be found in Colerus. "If you dig a trench around the root of a tree, and fill it with water, or keep the roots moist till it has bloomed, it will not be injured by the frost. Or, in spring, suspend a vessel filled with water from the tree. If you wish to preserve the blossom from being hurt by the frost, place a vessel of water below it, and the frost will fall into it."

Hoar FROST, a cold moist vapour, that is drawn up a little way into the air, and in the night falls again on the earth, when it is congealed into icy crystals of various figures. Hoar frost, therefore, is nothing but dew turned into ice by the coldness of the air.

Melioration of Aromatic Spirits by FROST. Mr Beaume observes, that aromatic spirituous waters have less scent when newly distilled than after they have been kept about six months: and he found that the good effect of age was produced in a short time by means of cold; and that, by plunging quart bottles of the liquor into a mixture of pounded ice and sea salt, the spirit, after having suffered for six or eight hours the cold hence resulting, proves as grateful as that which hath been kept many years. Simple waters also, after having been frozen, prove far more agreeable than they were before. Geoffroy takes notice of this melioration by frost. *Hist. Acad.* 1713.

Melioration of Land by FROST. See AGRICULTURE *Index*.

FROTH, a white light substance, formed on the surface of fluids by vehement agitation, consisting of air included in the films of water.

FROTH *Spit*, or *Cuckoo Spit*, a name given to a white froth, or spume, very common in the spring and first months of summer, on the leaves of certain plants, particularly on those of the common white field lychnis, or catchfly, thence called by some *spatling poppy*.

All writers on vegetables have taken notice of this froth, though few have understood the cause or origin of it till of late. It is formed by a little leaping animal, called by some the *flea grashopper*, by applying its anus close to the leaf, and discharging thereon a small drop of a white viscous fluid, which, containing some air in it, is soon elevated into a small bubble: before this is well formed, it deposits such another drop; and so on, till it is every way overwhelmed with a quantity of these bubbles, which form the white froth which we see. Within this spume it is seen to acquire four tubercles on its back, wherein the wings are enclosed: these bursting, from a reptile it becomes a winged animal: and thus, rendered perfect, it flies to meet its mate, and propagate its kind. It has an oblong, obtuse body, and a large head with small eyes. The external wings (for it has four) are of a dusky brown colour, marked with two white spots: the head is black. It is a species of CICADA.

FROWDE, PHILIP, an English poet, was the son of a gentleman who had been postmaster in the reign of Queen Anne. He was sent to the university of Oxford, where he had the honour of being distinguished by Addison, who took him under his protection. While he remained there, he became the author of several pieces of poetry, some of which in Latin were pure and elegant enough to entitle them to a place in the *Musæ Anglicanæ*. He likewise wrote two tragedies: The Fall of Saguntum, dedicated to Sir Robert Walpole; and Philotas, addressed to the earl of Chesterfield. He died at his lodgings at Cecil Street in the Strand, in 1738; and in the London Daily Post had the following character given him: "Though the elegance of Mr Frowde's writings has recommended him to the general public esteem, the politeness of his genius is the least amiable part of his character; for he esteemed the talents of wit and learning only as they were conducive to the excitement and practice of honour and humanity. Therefore, with a soul cheerful, benevolent, and virtuous, he was in conversation genteelly delightful, in friendship punctually sincere, in death Christianly resigned. No man could live more beloved, no private man could die more lamented." A fine eloge! and we have no reason to doubt the truth of it.

FRUCTESCENTIA, (from *fructus*, "fruit,") comprehends the precise time in which, after the fall of the flowers, the fruits arrive at maturity, and disperse their seeds.

In general, plants which flower in spring, ripen their fruits in summer, as rye; those which flower in summer have their fruits ripe in autumn, as the vine; the fruit of autumnal flowers ripens in winter, or the following spring, if kept in a stove or otherwise defended from excessive frosts. These frosts, says M. Adanson, are frequently so pernicious and violent as to destroy the greatest part of the perennial plants of Virginia and Mississippi, that are cultivated in France, even before they have exhibited their fruit. The plants which flower during our winter, such as those of the Cape of Good Hope, ripen their fruit in spring in our stoves.

FRUCTIFEROUS, signifies properly any thing that produces fruit.

FRUCTIFICATION of Plants, is defined by Linnæus to be the temporary part of a vegetable appropriated to generation, terminating the old vegetable and beginning the new. It consists of the following seven parts; viz. the calyx, corolla, stamen, pistillum, pericarpium, semen or seed, and receptaculum. See Botany.

FRUIT, in its general sense, includes whatever the earth produces for the nourishment and support of animals; as herbs, grain, pulse, hay, corn, and flax, every thing expressed by the Latins under the name *fruges*.

Fruit, in *Natural History*, denotes the last production of a tree or plant, for the propagation or multiplication of its kind; in which sense fruit includes all kinds of seeds, with their furniture, &c.

Fruit, in *Botany*, is properly that part of a plant wherein the seed is contained; called by the Latins *fructus*; and by the Greeks καρπος. The fruit in the Linnæan system is one of the parts of fructification, and is distinguished into three parts, viz. the pericarpium, seed, and receptacle, or *receptaculum seminum*. See Botany.

Colours extracted from Fruits. See the article *Colour-Making*.

Bread-Fruit. See Artocarpus, Botany *Index*.

Fruits, with regard to commerce, are distinguished into *recent*, *fresh*, and *dry*.

Recent Fruits are those sold just as they are gathered from the tree, without any farther preparation; as are most of the productions of our gardens and orchards, sold by the fruiterers.

Dry Fruits are those dried in the sun, or by the fire, with other ingredients sometimes added to them to make them keep; imported chiefly from beyond sea, and sold by the grocers. Such are raisins, currants, figs, capers, olives, cloves, nutmegs, pepper, and other spices; which see under their respective articles.

Under the denomination of *dry fruits* are also frequently included apples, pears, almonds, filberds, &c.

Fruit-Flies, a name given by gardeners and others to a sort of small black flies found in vast numbers among fruit trees, in the spring season, and supposed to do great injury to them. Mr Leeuwenhoeck preserved some of these flies for his microscosical observations. He found that they did not live longer than a day or two, but that the females during this time laid a great number of longish eggs. The gardeners, who suppose that these flies wound the leaves of the trees, are mistaken: it is true that they feed on their juices; but they have no instruments wherewith they can extract these for themselves: they feed on such as are naturally extravasated; and when there is not a sufficient quantity of these for their purpose, they haunt the places to which the pucerons resort, and feed on the juices which these little creatures extravasate by means of the holes they bore in the leaves with their trunks.

Fruit-Stones. The mischiefs arising from the custom which many people have of swallowing the stones of plums and other fruit are very great. The Philosophical Transactions give an account of a woman who suffered violent pains in her bowels for 30 years, returning once in a month or less. At length a strong purge being given her, the occasion of all these complaints was driven down from the bowels to the anus; where it gave a sensation of distension and stoppage, producing a continual desire of going to stool, but without voiding any thing. On the assistance of a careful hand in this case, there was taken out with a forceps a ball of an oval figure, of about ten drachms in weight, and measuring five inches in circumference. This had caused all the violent fits of pain which she had suffered for so many years; and, after voiding it, she became perfectly well The ball extracted looked like a stone, and felt very hard, but it swam in water. On cutting it through with a knife, there was found in the centre of it a plum stone; round which several coats of this hard and tough matter had gathered. Another instance given in the same papers is of a man, who, dying of an incurable colic, which had tormented him many years, and baffled the effects of medicines, was opened after death; and in his bowels was found a ball similar to that above mentioned; but somewhat larger, being six inches in circumferance, and weighing an ounce and a half. In the centre of this, as of the other, there was found the stone of a common plum, and the coats were of the same nature with those of the former.

These and several other instances mentioned in the same place, sufficiently show the folly of that common opinion that the stones of fruits are wholesome. For though by nature the guts are so defended by their proper mucus, that people very seldom suffer by things of this kind; yet if we consider the various circumvolutions of the guts, their valves and cells, and at the same time consider the hair of the skins of animals we feed on, the wool or down on herbs and fruit, and the fibres, vessels, and nerves of plants, which are not altered by the stomach; it will appear a wonder that instances of this sort of mischief are not much more common. Cherry stones, swallowed in great quantities, have occasioned the death of many people; and there have been instances even of the seeds of strawberries collecting into a lump in the guts, and causing violent disorders, which could not be cured without great difficulty.

Fruit Trees. With regard to these it may be observed, 1. That the cutting and pruning them when young hurt their bearing, though it contributes to the

the richness and flavour of the fruit, as well as to the beauty of the tree. 2. That kernel fruit trees come later to bear than stone fruit tress: the time required by the first, before they come to any fit age for bearing, being one with another five years; but when they do begin, they bear in greater plenty than stone fruit. 3. That stone fruit, figs, and grapes, commonly bear considerably in three or four years, and bear full crops the fifth and sixth year; and hold it for many years, if well ordered. 4. That fruit trees in the same neighbourhood will ripen a fortnight sooner in some grounds than in others of a different temperature. 5. That in the same country, hot or cold summers set considerably forwards, or put backwards, the same fruit. 6. That the fruit on wall trees generally ripen before those on standards, and those on standards before those on dwarfs. 7. That the fruit of all wall trees planted in the south and east quarters commonly ripen about the same time, only those in the south rather earlier than those in the east; those in the west are later by eight or ten days; and those in the north by 15 or 20. For the planting, pruning, grafting, &c. of fruit trees, see GARDENING.

FRUITERY, a place for the keeping of fruit, a fruit house, or fruit loft.

A fruitery should be inacessible to any thing of moisture; and should be as much as possible so, even to frost.

FRUMENTACEOUS, a term applied by botanists to all such plants as have a conformity with wheat, in respect of their fruits, leaves, ears, or the like.

FRUMENTARII, a kind of soldiers or archers under the western empire.

The first time we read of these officers is in the reign of the emperor Adrian, who made use of them to inform himself of whatever passed. They did not make any particular corps distinct from the rest of the forces, but there was a certain number of them in each legion. It is supposed, that they were at first a number of young persons, disposed by Augustus throughout the provinces, particularly on all the great roads, to acquaint the emperor, with all expedition, of every thing that happened.

Afterwards they were incorporated into the troops themselves, where they still retained their ancient name. As their principal office was the giving intelligence, they were often joined with the curiosi, with whom they agreed in that part of their office.

Their name of *frumentarii* is derived from their being also a sort of purveyors to the armies, cities, &c. collecting all the corn from the several provinces to furnish the commonwealth.

FRUMENTATION, in Roman antiquity, a largess of corn bestowed on the people. This practice of giving corn to the people was very ancient among the Romans, and frequently used to soothe the turbulent humour of the populace. At first the number of those to whom this largess was given was indeterminate, till Augustus fixed it at 200,000.

FRUSH, or RUNNING THRUSH. See FARRIERY *Index*.

FRUSTUM, in *Mathematics*, a part of some solid body separated from the rest.

The frustum of a cone is the part that remains, when the top is cut off by a plane paralled to the base; and is otherwise called a *truncated cone*. See CONIC *Sections*.

The frustum of a pyramid is also what remains after the top is cut off by a plane parallel to its base.

The frustum of a globe or sphere is any part thereof cut off by a plane, the solid contents of which may be found by this rule: To three times the square of the semidiameter of the base add the square of its height; then multiply that sum by the height, and this product multiplied by .5236 gives the solidity of the frustum.

FRUTEX, a SHRUB. Shrubs, according to Linnæus, make a branch of the seventh family in the vegetable kingdom; and are distinguished from trees, in that they come up without buds. But this distinction is not universal, though it be generally just with regard to those of Europe. Nature hath made no absolute distinction between trees and shrubs. *Frutex*, in its general acceptation, is a plant whose trunk is pereninal, gemmiparous, woody, dividing and subdividing into a great number of branches. In short, it is the epitome of a tree, exemplified in the rose bush.

FRY, in *Zoology*, signifies the spawn, or rather young, of fish.

FRYING-PAN, a dangerous shoal, which has received this appellation from its figure. It is situated at the entrance of Cape Fear river, in North Carolina, the southern part of which is in long. 75° W. and 33° 22′ N. Lat. 24 miles south-east by south of the light house on Bald Head.

FRYTH, JOHN, a martyr to the Protestant religion in the reign of Henry VIII. He was the son of an innkeeper at Seven Oaks in Kent; and educated in King's College, Cambridge, where he took the degree of bachelor of arts. Thence he removed to Oxford, and was made a junior canon of Wolsey's college. He had not been long in that university before he became acquainted with William Tyndale, a zealous Lutheran, with whom he conversed frequently on the abuses in religion. Fryth became a convert to Lutheranism, and publicly avowed his opinions. He was apprehended, examined by the commissary, and confined to his college. At length having obtained his liberty, in 1528 he went over to Germany, where he continued about two years; and then returned to England, more than ever determined in his religious sentiments. Finding at that time but few associates, he wandered about from place to place, till at last he was taken up at Reading as a vagrant, and set in the stocks, where he remained till he was near expiring for want of sustenance. He was at length relieved by the humanity of Leonard Cox, a schoolmaster; who finding him a man of letters, procured his enlargement, and administered to his necessities. Fryth now set out for London, where with more zeal than prudence, he began to make proselytes; but was soon apprehended by order of the chancellor Sir Thomas More, and sent prisoner to the Tower. Refusing to recant his opinions, he was condemned to the flames, and accordingly burnt in Smithfield, on the 4th of July 1533. He left several works behind him, which were printed in folio in 1573.

FUAGE, in old English writers, a tax of 12d. for every fire, levied in the time of Edward III

FUCINUS LACUS, in *Ancient Geography*, a lake of Italy

Fucinus. Italy in the country of the Marsi. Now *Lago di Celano*, from a cognominal citadel, lying on the south of the Abruzzo Ultra, in the kingdom of Naples, near the Apennines. This lake was under the protection of a god of the same denomination, whose temple stood on its banks. According to the testimony of ancient authors, it was subject to extraordinary risings and decreasings. The actual circumference is 47 miles: the breadth in the widest part is 10, in the narrowest 4; its depth 12 feet upon an average. But all these have varied prodigiously. Two miles up the plain, behind Avezzano, the fragments of boats, shells, and other marks of its ancient extent, have been casually discovered: and, on the contrary, there are people who remember when it did not flow nearer than within two miles of Avezzano. An immense tract of excellent lands is lost at every increase of its level. All round this noble piece of water rises a circle of grand mountains, some of them the highest in Italy, if we except the Alps, and many of them covered with snow; and at the foot of them are numerous villages, with rich and well cultivated farms. The environs of the lake, Mr Swinburne describes as all well enclosed, and the sides of the hills as covered with fine woods; its waters abound with fish of various kinds, and thither repair at stated seasons innumerable flights of wild fowl. As the swelling of the lake was attended with incredible damage, the Marsi had often petitioned the senate to drain it: Julius Cæsar would have attempted it, had he lived longer. His successors were averse to the project; till Claudius, who delighted in expensive difficult enterprises, undertook it. During the space of 11 years he employed 30,000 men in digging a passage through the mountain; and when every thing was ready for letting off the water, exhibited a superb naval spectacle on the lake. A great number of condemned criminals were obliged to act the parts of Rhodians and Sicilians in separate fleets, to engage in earnest, and to destroy one another for the entertainment of the court and the multitude of spectators that covered the hills: A line of well armed vessels and rafts loaded with soldiers surrounded the scene of action, in order to prevent any of the wretches from escaping; but it was with great difficulty and many threats that they could be brought to an engagement. When this savage diversion was ended, the operations for opening the passage commenced, and the emperor was very near being swept away and drowned by the sudden rushing of the waters towards it. However, either through the ignorance or negligence of the engineers, the work did not answer as was expected, and Claudius did not live long enough to have the faults amended: Nero abandoned the scheme through envy. Hadrian is said to have let off the water of the Fucinus; but none now escapes except through hidden channels formed by nature, which are probably subject to be obstructed, and thus occasion a superabundance of water in the lake, till some unknown cause removes the obstructions and again gives free passage.

Sir William Hamilton, who visited the Fucinus in 1785, says, "it is the most beautiful lake he ever saw, and would be complete if the neighbouring mountains were better wooded." It furnishes abundance of fish, though not of the best quality. There are a few large trout, but mostly tench, barbel, and dace. In the shallow water on the borders of the lake, he saw thousands of water snakes pursuing and preying upon a little kind of fish like our thornbacks, but much better armed; though their defensive weapons seemed to avail them but little against such ravenous foes. The opening made by Claudius he describes as still entire, though in many parts filled with earth and rubbish. He went into it with torches as far as he could. It is a covered underground canal three miles long, and part of it cut through a hard rock, and other parts supported by mason work, with wells to give light. Hadrian is said to have let off the waters of the lake: and our author is of opinion, that if the canal were cleared and repaired it would still answer that purpose, and thereby restore a great deal of rich land fit for cultivation.

Fucus. FUCUS, a name given by the ancients to certain dyes and paints. By this name they called a purple sea plant used by them to dye woollen and linen things of that colour. The dye was very beautiful, but not lasting; for it soon began to change, and in time went wholly off. This is the account Theophrastus gives of it.

The women of those times also used something called *fucus*, to stain their cheeks red; and many have supposed, from the same word expressing both, that the same substance was used on both occasions. But this, on a strict inquiry, proves not to be the case. The Greeks called every thing *fucus* that would stain or paint the flesh. But this peculiar substance used by the women to paint their cheeks was distinguished from the others by the name of *rizion* among the more correct writers, and was indeed a root brought from Syria into Greece. The Latins, in imitation of the Greek name, called this root *radicula;* and Pliny very erroneously confounds the plant with the *radix lunaria*, or *struthion* of the Greeks.

The word *fucus* was in those times become such an universal name for paint, that the Greeks and Romans had a *fucus metallicus*, which was the ceruse used for painting the neck and arms white: after which they used the *purpurissum*, or red fucus of the *rizium*, to give the colour to the cheeks. In after-times they also used a peculiar *fucus* or paint for the purpose, prepared of the *creta argentaria*, or silver-chalk, and some of the rich purple dyes that were in use at that time: and this seems to have been very little different from our rose-pink; a colour commonly sold at the colour shops, and used on like occasions.

Fucus, in the Linnæan system of botany, is a genus of the order of algæ, belonging to the cryptogamia class of plants.

Fuego. FUEGO, or Fogo, one of the Cape de Verd islands, in the Atlantic ocean. It is much higher than any of the rest; and seems at sea to be one single mountain, though on the sides there are deep valleys. There is a volcano at the top which burns continually, and may be seen a great way off at sea. It vomits a great deal of fire and smoke, and throws out huge pieces of rock to a vast height; and sometimes torrents of melted matter run down the sides. The Portuguese, who first inhabited it, brought negro slaves with them, and a stock of cows, horses, and hogs; but the chief inhabitants now are blacks of the Romish religion. W. Long. 24. 20. Lat. 15. 0.

FUEL,

FUEL, whatever is proper to burn or make a fire; as wood, turf, peat, bituminous earths, coal, &c.

FUEN-HOA, a city of China, in the province of Petcheli, celebrated for its extent and the number of its inhabitants, as well as for the beauty of its streets and triumphal arches. It is situated near the great wall, amidst mountains; and has under its jurisdiction, besides two cities of the second, and eight of the third class, a great number of fortresses, which bar the entrance of China against the Tartars.

FUGALIA, in Roman antiquity, a feast supposed by some to be the same with the *refugium*, held on the 24th of February, in memory of the expulsion of the kings and the abolishing of monarchical government. Others again distinguish the fugalia from the regifuge. And others think that the fugalia was the same with the *poplifugia*, or the feast of Fugia, the goddess of joy, occasioned by the rout of an enemy, which was the reason the people abandoned themselves to riot and debauchery.

FUGITIVE, a person obliged to fly his country, or remove from a place where he had some abode or establishment, on account of his crimes, debts, or other occasions.

Fugitive Pieces, among the learned, denote those little compositions which are printed on loose sheets or half sheets; thus called, because easily lost and soon forgotten.

FUGUE, in *Music*, (from the Latin *fuga*, "a chase"), a piece of music sometimes longer and sometimes shorter, in which, agreeable to the rules of harmony and modulation, the composer treats a subject; or, in other words, what expresses the capital thought or sentiment of the piece, in causing it to pass successively and alternately from one part to another.

These are the principal rules of the fugue; of which some are peculiar to itself, and others common to it with what the French call *imitation*.

1. The subject proceeds from the tonic to the dominant, or from the dominant to the tonic, in rising or descending.

2. Every fugue finds its response in the part immediately following that which commenced.

3. That response ought to resume the subject in the interval of a fourth or fifth above or below the key, and to pursue it as exactly as the laws of harmony will admit; proceeding from the dominant to the tonic when the subject is introduced from the tonic to the dominant, and moving in a contrary direction when the subject is introduced from the dominant to the tonic. One part may likewise resume the same subject in the octave or unison of the preceding; but in that case, it is a repetition rather than a real response.

4. As the octave is divided into two unequal parts, of which the one contains four gradations descending from the tonic to the dominant, and the other only three in continuing the ascent from the dominant to the tonic; this renders it necessary to have some regard to this change in the expression of the subject, and to make some alterations in the response, that we may not quit the cords that are essential to the mode. It is a different case when the composer intends to alter the modulation; for there the exactness of the response itself, when taken in a different tone, produces the alteration proper for this change.

5. It is necessary that the fugue should be planned in such a manner, that the response may commence before the close of the first air, so that both the one and the other may be in part heard at the same time: that, by this anticipation, the subject may be as it were connected with itself, and that the art of the composer may discover itself in this concourse. It is absolute mockery, instead of a fugue, to impose upon the hearers the same air, merely transposed from one key to another, without any other restraint than an accompaniment afterwards formed at pleasure. This deserves at best no better name than what the French call *imitation*. See Imitation.

Besides these rules, which are fundamental, there are others which, though prescribed by taste alone, are not less essential. Fugues, in general, render music more noisy than agreeable; it is for this reason that they are more agreeable in the chorus than anywhere else. Now, as their chief merit consists in fixing the ear on the principal air or subject, which for this reason is made to pass incessantly from part to part, and from mode to mode, the composer ought to exert his care in preserving that air always distinct; or to prevent it from being absorbed in, or confounded with, the other parts. To produce this effect, there are two different ways; one in the movement, which must be incessantly contrasted with itself; so that, if the procedure of the fugue be accelerated, the other parts move gravely and with protracted notes; or, on the contrary, if the motion of the fugue be slow and solemn, the accompaniments must have more and quicker business. The other method is to extend the harmony, by removing the parts at a greater distance one from the other; lest the others, too nearly approximated to that which contains the subject, should be confounded with it, and prevent it from being distinguished with sufficient clearness; so that what would be an imperfection anywhere else, becomes here a beauty.

The unity of melody should be preserved: this is the great and general rule, which must frequently be practised by different means. The cords must be chosen, and the intervals, so that one particular sound may produce the same effect; this can only result from the unity of the melody. It will sometimes be necessary to employ voices and instruments of different kinds, that the parts which ought to prevail may be most easily distinguished; this again shows the necessity of preserving the unity of the melody. Another object of attention, no less necessary, is, in the different connections of modulation which are introduced by the procedure and progress of the fugues, to cause all these modulations to correspond at the same time in all the parts, to connect the whole in its progress by an exact conformity of modes: lest, if one part be in one mode, and another in another, the general harmony should be in none at all, and for that reason should no longer be able to produce simple effects upon the ear, nor simple ideas in the mind; which is another reason for preserving unity of melody. In a word, in every fugue the confusion of melodies and modulations is at once what a composer has most to fear, and will find the greatest difficulty in avoiding; and as this kind of music never produces a pleasure above mediocrity, one may say that a fine fugue is, though the masterpiece of an excellent harmonist, ungrateful to his toil.

There

There are still several other kinds of fugues; such as the perpetual fugue*, the double fugue, the inverted fugue.

The inverted fugue is a manner of composition, in which the flying part proceeds in a contrary direction to the other fugue, which had been formerly fixed in the same piece of music. Thus, when the first fugitive part is heard in ascending from the tonic to the dominant, or from the dominant to the tonic, the counter fugue ought to be heard in descending from the dominant to the tonic, or from the tonic to the dominant, and *vice versa*. Its other rules are exactly like those of the common fugue.

* See *Canon*.

FULCRUM, in *Mechanics*, the prop or support by which a lever is sustained.

FULDA, a considerable town of Germany, in the circle of the Upper Rhine, and in the Buchow, with a celebrated abbey; whose abbot was primate of the abbeys of the empire, perpetual chancellor of the emperor, and sovereign of this small territory, which is now chiefly included in the dominions of Hesse Cassel. It is seated on the river Fulda, 55 miles south of Cassel. E. Long. 9. 33. N. Lat. 50. 32.

FULGORA, a genus of insects belonging to the order of hemiptera. See ENTOMOLOGY *Index*.

FULHAM, a village of Middlesex, four miles from London, with 5903 inhabitants in 1811. The Danes in 869 wintered at this place till they retired to the continent. It was in the Conqueror's time held of the king by the canons of St Paul's; and there is an ancient house here, which is moated about, and belongs to the see of London, whose bishop has a palace here, and the demesne has belonged to that diocese from 1067. From this place to Putney there is a wooden bridge over the Thames, where not only horses, coaches, and all carriages, but even foot passengers, pay toll. The church here is both a rectory and a vicarage.

FULICA, the GALLINULE and COOT, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

FULIGINOUS, whatever proceeds from a thick sooty smoke, such as lamp black.

FULIGNO, a city of Italy, in the pope's territories, 10 miles north of Spoletto.

FULIGO, in *Natural History*, a species of pumice-stone. See PUMICE.

FULLER, DR THOMAS, a learned English divine, was born at Alvinckle, near Oundle, in Northamptonshire, about the year 1608, and studied at Cambridge. He was chosen minister of St Bennet's there; and at about 23 years of age, his merit procured him a fellowship in Sidney-college, and a prebend in Salisbury cathedral. He was soon after presented to the rectory of Broad Windsor in Dorsetshire; and afterwards was made lecturer of the Savoy in London: but upon the pressing of the covenant, he retired to Oxford; and soon after accompanied Sir Ralph Hopton as his chaplain in the army, which he attended in their marches from place to place. After the death of King Charles I. he obtained the living of Waltham-abbey, and was appointed lecturer of St Clement's; and shortly after removed to the lecture of St Bridge's, Fleet-street. Upon the restoration, he recovered his prebend in the cathedral of Salisbury, was appointed chaplain extraordinary to his majesty, and created doctor of divinity. It is said, his memory was so tenacious and comprehensive, that he could make use of a sermon *verbatim* if he once heard it. He once undertook, in passing to and from Temple-bar to the Poultry, to tell at his return every sign as it stood in order on both sides of the way, repeating them either backwards or forwards; and this task he actually performed. He wrote, 1. A History of the Holy War. 2. The Church-History of Britain, in folio. 3. Andronicus, or the Unfortunate Politician, in 8vo. 4. A Pisga-sight of Palestine. 5. A History of English Worthies; and other works. He died in August 1661; and was interred in the chancel of Cranford church, in Middlesex, whither his body was attended by at least 200 of his brethren of the ministry.

FULLER, a workman employed in the woollen manufactories to mill or scour cloths, serges, and other stuffs, in order to render them more thick, compact, and durable. See FULLING.

FULLER's Earth, in *Natural History*, a species of clay, of a grayish ash-coloured brown, in all degrees from very pale to almost black, and it has generally something of a greenish cast. It is very hard and firm, of a compact texture, of a tough and somewhat dusty surface that adheres slightly to the tongue. It is very soft to the touch, not staining the hands, nor breaking easily between the fingers. It has a little harshness between the teeth, and melts freely in the mouth. Thrown into water, it makes no ebullition or hissing; but swells gradually in bulk, and falls into a fine soft powder. It makes no effervescence with aquafortis.

The greatest quantity and the finest earth of this kind in the world, is dug in the pits at Wavedon, near Woburn in Bedfordshire. The strata in these pits lie thus: From the surface to the depth of six feet, there are several layers or beds of sand, all reddish, but some lighter coloured than others. Under these there is a thin stratum of a sand-stone, which they break through, and then there is the fuller's earth. The upper stratum of this is about a foot thick: the workmen call it *cledge*, and throw it aside as useless; being commonly fouled with the sand which originally covered it, and which insinuates itself a good way into it. After this, they come to the fine fuller's earth for sale, which lies to the depth of eight feet more. The matter of this is divided into several layers, there being commonly about a foot and a half between one horizontal fissure and another. Of these several layers, the upper half, where the earth breaks itself, is tinged red; which seems to be owing to the running of the water upon it from among the sands above; some of which are probably of a ferruginous nature, or have ferruginous matter among them. This reddish fuller's earth the workmen call *crop;* and between the cledge and this there is a thin stratum of matter, of less than an inch, which in taste, colour, and external appearance, resembles the terra Japonica of the shops. The lower half of the strata of fuller's earth they call *wall-earth*. This is untinged with the red colour of the other, and seems the most proper for fulling. Under the fuller's earth there is a stratum of white and coarse stone about two feet thick. They seldom dig through this; but if they do, they find more strata of sand.

This earth is of great use in scouring cloths, stuffs, &c. imbibing all the grease and oil used in preparing, dressing,

dressing, &c. of the wool; for which reason it is made a contraband commodity, and is not to be exported under the penalty of 1s. for every pound weight. See FULLING.

FULLER's Weed, or *Teazle.* See DIPSACUS, BOTANY *Index.*

FULLERY, a place where cloths, &c. are fulled. See the next article.

FULLING, the art or act of cleansing, scouring, and pressing cloths, stuffs, and stockings, to render them stronger, closer, and firmer: called also *milling.* Pliny (lib. vii. cap. 56.) assures, that one Nicias, the son of Hermias, was the first inventor of the art of fulling: and it appears by an inscription, quoted by Sir G. Wheeler, in his Travels through Greece, that this same Nicias was a governor in Greece in the time of the Romans.

Fulling of woollen cloths, depends, like felting, so entirely upon the structure of wool and hair, that those who have read our account of that process, will not find it difficult to comprehend the following observations.

The asperities with which the surface of wool is everywhere surrounded, and the disposition which it has to assume a progressive motion towards the root, render the spinning of wool, and making it into cloth, difficult operations. In order to spin wool, and afterwards convert it into cloth, its fibres must be covered with a coating of oil, which, filling the cavities, renders the asperities less sensible; in the same way as oil renders the surface of a very fine file less rough, when rubbed over it. When the piece of cloth is finished, it must be cleansed from this oil; which would cause it to soil whatever it came in contact with, besides giving it a disagreeable smell, and prevent its taking the colour which is intended to be given to it by the dyer. To deprive it of the oil, it is carried to the fulling-mill, where it is beat with hammers in a trough full of water, in which some clay has been mixed; the clay combines with the oil, which it separates from the cloth, and both together are washed away by the fresh water which is brought to it by the machine; thus, after a certain time, the oil is entirely washed out of the cloth.

But the scouring of the cloth is not the only object in fulling it; the alternate pressure given by the mallets to the piece of cloth, occasions, especially when the scouring is pretty far advanced, an effect analogous to that which is produced upon hats by the hands of the hatter; the fibres of wool which compose one of the threads, whether of the warp or the woof, assume a progressive movement, introduce themselves among those of the threads nearest to them, then into those which follow; and thus, by degrees, all the threads, both of the warp and the woof, become felted together. The cloth, after having, by the above means, become shortened in all its dimensions, partakes both of the nature of cloth and of that of felt; it may be cut without being subject to ravel, and, on that account, we are not obliged to hem the edges of the pieces of which cloths are made. Lastly, as the threads of the warp and those of the woof are no longer so distinct and separated from each other, the cloth, which has acquired a greater degree of thickness, forms a warmer clothing. Knit worsted also is, by fulling, rendered less apt to run, in case a stitch should happen to drop in it.

The fulling of cloths and other stuffs is performed by a kind of water-mill, thence called a *fulling* or *scouring mill.* Fulling.

These mills, excepting in what relates to the millstones and hopper, are much the same with corn-mills: and there are even some which serve indifferently for either use: corn being ground, and cloths fulled, by the motion of the same wheel. Whence, in some places, particularly in France, the fullers are called *millers;* as grinding corn and milling stuffs at the same time.

The principal parts of the fulling-mill are, The wheel, with its trundle; which gives motion to the tree or spindle, whose teeth communicate it to the pestles or stampers, which are hereby raised and made to fall alternately, according as its teeth catch on or quit a kind of latch in the middle of each pestle. The pestles and troughs are of wood; each trough having at least two, sometimes three pestles, at the discretion of the master, or according to the force of the stream of water. In those troughs are laid the cloths, stuffs, &c. intended to be fulled: then, letting the current of water fall on the wheel, the pestles are successively let fall thereon, and by their weight and velocity stamp and press the stuffs very strongly, which by this means become thickened and condensed. In the course of the operation, they sometimes make use of urine, sometimes of fuller's earth, and sometimes of soap. To prepare the stuffs to receive the first impressions of the pestle, they are usually laid in urine; then in fuller's earth and water; and, lastly, in soap dissolved in hot water. Soap alone would do very well; but this is expensive: though fuller's earth, in the way of our dressing, is scarce inferior thereto; but then it must be well cleared of all stones and grittinesses, which are apt to make holes in the stuff. As to urine, it is certainly prejudicial, and ought to be entirely discarded; not so much on account of its ill smell, as of its sharpness and saltness, which qualities are apt to render the stuffs dry and harsh.

The true method of fulling with soap is delivered by Mons. Colinet, in an authentic memoir on that subject, supported by experiments made by order of the marquis de Louvois, then superintendant of the arts and manufactories of France; the substance of which we shall here subjoin.

Method of FULLING *Cloths and Woollen Stuffs with Soap.*—A coloured cloth, of about 45 ells, is to be laid in the usual manner in the trough of a fulling-mill; without first soaking it in water, as is commonly practised in many places. To full this trough of cloth, 15 pounds of soap are required; one-half of which is to be melted in two pails of river or spring water, made as hot as the hand can well bear it. This solution is to be poured by little and little upon the cloth, in proportion as it is laid in the trough: and thus it is to be fulled for at least two hours; after which it is to be taken out and stretched. This done, the cloth is immediately returned into the same trough, without any new soap, and there fulled two hours more. Then taking it out, they wring it well, to express all the grease and filth. After the second fulling, the remainder of the soap is dissolved as in the former, and cast four different times on the cloth; remembering to take out the cloth every two hours, to stretch it, and undo the plaits and wrinkles it has acquired in the trough.

When

When they perceive it sufficiently fulled, and brought to the quality and thickness required, they scour it for good in hot water, keeping it in the trough till it be quite clean. As to white cloths; in regard these full more easy and in less time than coloured ones, a third part of the soap may be spared.

Fulling of Stockings, Caps, &c. should be performed somewhat differently; viz. either with the feet or the hands; or a kind of rack, or wooden machine, either armed with teeth of the same matter, or else horses or bullocks teeth. The ingredients made use of herein are, urine, green soap, white soap, and fuller's earth. But the urine also is reckoned prejudicial here. Woven stockings, &c. should be fulled with soap alone: for those that are knit, earth may be used with the soap. Indeed it is frequent to full these kinds of works with the mill, after the usual manner of cloth, &c. But that is too coarse and violent a manner, and apt to damage the work unless it be very strong.

FULMAR, in *Ornithology*. See PROCELLARIA, ORNITHOLOGY *Index*.

FULMAR, or *Foumart*. See MUSTELA, MAMMALIA *Index*.

FULMINATING, something that thunders or resembles thunder.

Fulminating Gold, Silver, Copper, Quicksilver, &c. See CHEMISTRY *Index*.

FULMINATION, in *Chemistry*, the same with detonation.

FULMINATION, in the Romish canon law, a sentence of a bishop, official, or other ecclesiastic appointed by the pope, by which it is decreed that some bull sent from the pope shall be executed.

FUMARIA, FUMITORY, a genus of plants belonging to the diadelphia class, and in the natural method ranking under the 24th order, *Corydales*. See BOTANY *Index*.

FUMIGATION, in *Chemistry*, a kind of calcination, when metals or other hard bodies are corroded or softened by receiving certain fumes for that purpose.

FUMIGATION, in *Medicine*. By the subtile fumes that are inspired as well as inhaled into our bodies, much benefit or prejudice is produced, according to the nature of the matter, and the constitution into which it is received; as is evident from the palsies produced among workers in lead-mines, &c. and the benefits received in many cases when the air is impregnated with salutary materials. Catarrhs and catarrhous coughs are relieved by fumes received with the breath; and, by the same method, expectoration is assisted in humoural asthmas; and even ulcers in the lungs are said to have been healed by this method. The advantage of mercurial fumigations in the cure of venereal ulcers is known to every practitioner.

FUMITORY. See FUMARIA, BOTANY *Index*.

FUNAMBULUS, among the Romans, was what we call a *rope-dancer*, and the Greeks *schœnobates*. See *Rope-Dancer*.

There was a funambulus, it seems, who performed at the time when the Hecyra of Terence was acted; and the poet complains, that the spectacle prevented the people from attending to his comedy. *Ita populus studio stupidus in* funambulo, *animum occuparat*.

At Rome, the funambuli first appeared under the consulate of Sulpicius Pæticus and Licinius Stolo, who were the first introducers of the scenic representations. It is added, that they were first exhibited in the island of the Tyber, and that the censors Messala and Cassius afterwards promoted them to the theatre.

In the *Floralia*, or *ludi Florales*, held under Galba, there were funambulatory elephants, as we are informed by Suetonius. Nero also showed the like, in honour of his mother Agrippina. Vopiscus relates the same of the time of Carinus and Numerianus.

FUNCHAL, the capital of Madeira, situated round a bay, on a gentle ascent, and containing about 15,000 inhabitants. It is watered by several streams from the mountains; and is defended by a castle on a steep rock, which is surrounded by the sea at high water. The houses are built of brick or free-stone; but the streets are narrow, dark, and dirty. W. Long. 16. 49. N. Lat. 32. 38.

FUNCTION, the act of fulfilling the duties of any employment.

FUNCTION, being also applied to the actions of the body, is by physicians divided into vital, animal, and natural. The *vital* functions are those necessary to life, and without which the individual cannot subsist; as the motion of the heart, lungs, &c. The *natural* functions are such as it cannot subsist any considerable time without; as the digestion of the aliment, and its conversion into blood. Under *animal* functions are included the senses of touching, tasting, &c. memory, judgment, and voluntary motion; without any or all of which an animal may live, but not very comfortably.

The animal functions perform the motion of the body by the action of the muscles; and this action consists chiefly in the shortening the fleshy fibres, which is called *contraction*, the principal agents of which are the arteries and nerves distributed in the fleshy fibres.

All parts of the body have their own functions, or actions, peculiar to themselves. Life consists in the *exercise* of these functions, and health in the *free and ready* exercise of them.

FUNCTION, a term used in analytics for an algebraical expression any how compounded of a certain letter or quantity with other quantities or numbers; and the expression is said to be a function of that letter or quantity. Thus $a-4x$, or $ax+3x^2$, or $2x-a\sqrt{a^2-x^2}$, or x^c, or c^x, is each of them a function of the quantity x.

FUND, in general, signifies any sum of money appropriated for a particular purpose. Thus, that part of the national revenue which is set apart for the payment of the national debt, is called the *sinking fund*. But, when we speak of *the funds*, we generally mean the large sums which have been lent to government, and constitute the national debt; and for which the lenders, or their assignees, receive interest from revenues allotted for that purpose. The term *stock* is used in the same sense, and is also applied to the sums which form the capital of the bank of England, the East India and South Sea companies; the proprietors of which are entitled to a share of the profits of the respective companies.

The

Fund.

The practice of funding was introduced by the Venetians and Genoese in the 16th century, and has been adopted since by most of the nations in Europe. Princes had often borrowed money, in former times, to supply their exigencies, and sometimes mortgaged their territories in security: but these loans were generally extorted, and their payment was always precarious; for it depended on the good faith and success of the borrower, and never became a regular burden on posterity. The origin of funds is derived from the peculiar manners and circumstances of modern Europe. Since the invention of gunpowder, and the progress of commerce, the military occupation has become a distinct employment in the hands of mercenaries; the apparatus of war is attended with more expence; and the decision of national quarrels has often been determined by command of money rather than by national bravery. Ambitious princes have therefore borrowed money, in order to carry on their projects with more vigour. Weaker states have been compelled, in self-defence, to apply to the same resource; the wealth introduced by commerce has afforded the means; the regularity of administration, established in consequence of the progress of civility, has increased the confidence of individuals in the public security; the complicated system of modern policy has extended the scenes of war, and prolonged their duration; and the colonies established by mercantile nations have rendered them vulnerable in more points, and increased the expence of defending them.

When a greater sum has been required for the annual expence than could easily be supplied by annual taxes, the government have proposed terms to their own subjects, or foreigners, for obtaining an advance of money by mortgaging the revenue of future years for their indemnification. This mortgage may either be for a limited period, or perpetual. If the sum allotted annually for the benefit of those who advance the money, be considerably greater than the interests of the sums advanced, they may agree to accept of such allowance, for a limited time, as a full equivalent. Thus, they may either agree for the casual produce of the revenue assigned; or a fixed annuity for a greater or less number of years; or a life annuity to themselves or nominees; or an annuity for two or more lives; or an annuity, with the benefit of survivorship, called a *tontine*, in which scheme, the whole sum to which the original annuitants were entitled continues to be distributed among the survivors.

The establishment of the funds was introduced in Britain at the Revolution; and has since been gradually enlarged, and carried to an amazing extent. The various methods above mentioned have been used in their turns, but perpetual annuities have been granted for the greatest part; and, even when the money was originally advanced on other conditions, the lenders have been sometimes induced, by subsequent offers, to accept of perpetual annuities, instead of the former terms. The debt for which perpetual annuities are granted, is called the *redeemable debt*, and the other is called the *irredeemable debt*. Although the debts thus contracted by government are seldom paid for a long term of years; yet any creditor of the public may obtain money for what is due him when he pleases, by transferring his property in the funds to another; and regular methods are appointed for transacting these transfers in an easy manner. By means of this, the stocks become a kind of circulating capital; and have the same effect, in some respects, as the circulating money in the nation. When a stockholder transfers his share, he may sometimes be able to obtain a greater price than the original value, and at other times be obliged to accept of a less one. The value of the funds depends on the proportion between the interest they bear, and the benefit which may be obtained by applying the money to other purposes. It is influenced by the plenty or scarcity of money, and by the quantity of the public debt; and it is impaired by any event which threatens the safety, or weakens the credit, of the government.

The business of stock-jobbing is founded on the variation of the prices of stock. Persons possessed of real property may buy or sell stock, according to their notion that the value is likely to rise or fall, in expectation of making profit by the difference of price. And a practice has taken place among persons who often possess no property in the funds, to contract for the sale of stock, against a future day, at a price now agreed on. For instance: A agrees to sell B 1000l. of bank stock, to be transferred, in 20 days, for 1200l. A has, in fact, no such stock; but, if the price of bank stock, on the day appointed for the transfer, should be only 118 per cent. A may purchase as much as will enable him to fulfil his bargain for 1180l. and thus gains 20l. by the transaction; on the contrary, if the price of bank stock be 125 per cent. he will lose 50l. The business is generally settled without any actual purchase or transfer of stock, by A paying to B, or receiving from him, the difference between the current price of the stock on the day appointed and the price bargained for.

This practice, which is really nothing else than a wager concerning the price of stock, is contrary to law; yet it is carried on to a great extent. In the language of Exchange Alley, where matters of this kind are transacted, the buyer is called a *bull*, and the seller a *bear*. As neither party can be compelled by law to implement these bargains, their sense of honour, and the disgrace and loss of future credit, which attend a breach of contract, are the principles by which the business is supported. When a person declines to pay his loss, he is called a *lame duck*, and dare never afterwards appear in the Alley. This opprobrious appellation, however, is not bestowed on those whose failure is owing to want of ability, providing they make the same surrender of their property voluntarily, which the law would have exacted if the debt had been entitled to its sanction.

The interest or dividend on the stock is paid half-yearly; and the purchaser has the benefit of the interest due on the stock he buys, from the last term to the time of purchase. Therefore the prices of the stocks rise gradually, *cæteris paribus*, from term to term, and fall at the term when the interest is paid. In comparing the prices of the different stocks, it is necessary to advert to the term when the last interest was paid: and, allowance being made for this circumstance, the prices of all the government stocks, which bear interest at the same rate, must be nearly the same, as they all depend on the same security.

When a loan is proposed, such terms must be offered to the lenders, as may render the transaction beneficial: and this is now regulated by the prices of the old stocks. If the stocks, which bear interest at 4 per cent. sell at par, or rather above, the government may expect to borrow money at that rate; but, if these stocks are under par, the government must either grant a higher interest, or some other advantage to the lenders, in compensation for the difference. For this purpose, besides the perpetual annuity, another annuity has sometimes been granted for life, or for a term of years. Lotteries have frequently been employed to facilitate the loan, by entitling the subscribers to a certain number of tickets, for which no higher price is charged than the exact value distributed in prizes, though their market price is generally 2l. or 3l. higher. Sometimes an abatement of a certain proportion of the capital has been granted, and a lender entitled to hold 100l. stock, though in reality he advanced no more perhaps than 95l.

It belongs to the chancellor of the exchequer to propose the terms of the loan in parliament: and he generally makes a previous agreement with some wealthy merchants, who are willing to advance the money on the terms proposed. The subscribers to the loan deposit a certain part of the sum subscribed; and are bound to pay the rest by instalments, or stated proportions, on appointed days, under pain of forfeiting what they have deposited. For this they are entitled, perhaps, not only to hold their share in the capital, but to an annuity for 10 years, and to the right of receiving a certain number of lottery tickets on advantageous terms. They may sell their capital to one person, their annuity to a second, and their right to the tickets to a third. The value of all these interests together is called *omnium;* and, in order to obtain a ready subscription, it ought to amount to 102l. or upwards, on 100l. of capital. This difference is called the bonus to the subscribers.

The capital advanced to the public, in the form of transferable stocks, and bearing interest from taxes appropriated for that purpose, is called the *funded debt.* Besides, there is generally a considerable sum due by government, which is not disposed of in that manner, and therefore is distinguished by the appellation of the *unfunded debt.* This may rise from any sort of national expence, for which no provision has been made, or for which provision has proved insufficient. The chief branches are,

1st, *Exchequer Bills.* These are issued from the exchequer, generally by appointment of parliament, and sometimes without such appointment, when exigencies require. They bear interest from the time when issued, and are taken in by the Bank of England, which promotes their circulation.

2d, *Navy Bills.* The sums annually granted for the navy have always fallen short of what that service required. To supply that deficiency, the admiralty issues bills in payment of victuals, stores, and the like, which bear interest six months after the time issued. The debt of the navy thus contracted is discharged, from time to time by parliament.

In time of war, the public expences, since the Revolution, have always been much greater than the annual revenue; and large sums have consequently been borrowed. In time of peace, the revenue exceeds the expence, and part of the public debt has frequently been paid off. But, though there have been more years of peace than of war since the funds were established, the debts contracted during each war have much exceeded the payments during the subsequent peace. This will appear by the following abstract of the progress of the national debt.

Debt at peace of Ryswick, 1697	L. 21,515,472
Debt at the beginning of war 1701	16,394,701
Discharged during peace 1697 to 1701	5,121,071
Debt at peace of Utrecht 1714, including value of annuities afterwards subscribed to South Sea stock -	55,282,978
Contracted in war 1701 to 1714	38,888,277
Debt at beginning of war 1740, including 1,000,000l. charged on civil list	47,954,623
Discharged during peace 1714 to 1739	7,328,355
Debt at peace of Aix-la-Chapelle, 1748	79,193,313
Contracted during war 1740 to 1748	31,238,690
Debt at beginning of war 1756	73,289,673
Paid off during peace 1748 to 1756	5,903,640
Debt funded at the peace 1763, including 9,839,597l. then owing, which was funded in the subsequent years	133,957,270
Besides this, there was about 6,000,000l. of debt paid off, without ever being funded.	
Funded debt, 1775 - - -	125,000,000
Paid off during peace 1763 to 1775, besides unfunded debt above mentioned	8,959,270
Funded at the peace 1783 -	211,363,254

The following is a state of the national debt at a later period.

Amount of funded debt on 5th January 1805 - - -	L. 603,925,792
Stock created by loan of 1805 -	38,700,000
	L. 642,625,792
Transferred for the redemption of the land tax - - -	22,000,000
	L. 620,925,792
Redeemed by the commissioners for managing the sinking fund -	113,500,000
Leaving as the amount of the national debt on the 31st January 1806	L. 507,125,792

The total amount of the public funded debt of the united kingdom, on the 5th January 1819, according to the finance book, was 900,212,132l. and the annual interest at the same period was 30,947,150l. Of this debt 8,398,155l. consists of loans to Germany and Portugal. The above, however, is the *nominal* amount of the public debt; but its real amount, or the sum necessary to extinguish it, supposing the average interest received to be 5 per cent. would be about 619,000,000l.

The original provision of the sinking fund, of a million per annum, with the additions that have since been made to it; and the dividends on stock, bought up by the commissioners for managing that fund, amount at this time (1820) to fifteen millions per annum. It was calculated that the future rate of accumulation of the sinking fund, continuing the same as hitherto, namely,

namely, at 5 per cent. the whole amount of the national debt would be extinguished in 45 years. But the abolition of the income tax in 1816, and the great distress felt by the agricultural, commercial, and manufacturing classes, has put an end to these expectations. Since the close of the war, the real sinking fund, or the excess of the revenue over the expenditure, has not exceeded two millions per annum. The fruitless attempt to enlarge this fund, by imposing 3,000,000l. of new taxes in 1819, has only shewn, that taxation in the present state of the country has nearly reached its limit. See the nature and operation of the system fully explained in the article FUNDING SYSTEM, in the SUPPLEMENT.

FUNDAMENT, in *Anatomy*, the lowest part of the intestinum rectum, called by anatomists the *anus*. See ANATOMY.

FUNDAMENTAL, in general, something that serves as a base or foundation for another.

FUNDAMENTAL, in *Music*. A *fundamental sound* is that which forms the lowest note of the CHORD, and from whence are deduced the harmonical relations of the rest; or, which serves for a key to the tone †. The *fundamental bass* is that which serves for a foundation to the harmony. A *fundamental chord* is that whose base is fundamental, and in which the sounds are ranged in the same order as when they are generated, according to the experiment so often repeated by M. d'Alembert in his Preliminary Discourse and Elements of Music ‡. But as this order removes the parts to an extreme distance one from the other, they must be approximated by combinations or inversions; but if the bass remains the same, the chord does not for this reason cease to bear the name of *fundamental*. Such an example is this chord, *ut mi sol*, included in the interval of a fifth: whereas, in the order of its generation, *ut sol mi*, it includes a tenth, and even a seventeenth; since the fundamental *ut* is not the fifth of *sol*, but the octave of that fifth.

Fundamental Bass. This part in music is, according to Rousseau, and indeed according to all authors who have proceeded upon M. Rameau's experiment, in its primary idea, that bass which is formed by the fundamental notes of every perfect chord that constitutes the harmony of the piece; so that under each chord it causes to be heard, or understood, the fundamental sound of that particular chord; that is to say, the sound from whence it is derived by the rules of harmony. From whence we may see, that the fundamental bass can have no other contexture than that of a regular and fundamental succession, without which the procedure of the upper parts would be illegitimate.

To understand this well, it is necessary to be known, that, according to the system of Rameau, which Rousseau has followed in his Dictionary, every chord, though composed of several sounds, can only have one which is its fundamental, viz. that which produces this chord, and which is its bass according to the direct and natural order. Now, the bass which prevails under all the other parts, does not always express the fundamental sounds of the chords; for amongst all the sounds which form a chord, the composer is at liberty to transfer to the bass that which he thinks preferable; regard being had to the procedure of that bass, to the beauty of the melody, and above all to the expression, as may afterwards be explained. In this case the real fundamental sound, instead of retaining its natural station, which is in the bass, will either be transferred to some of the other parts, or perhaps even entirely suppressed, and such a chord is called an *inverted* chord. Fundamental

In reality, says Rameau, a chord inverted does not differ from the chord in its direct and natural order from which it was produced: but as these sounds form different combinations, these combinations have long been taken for fundamental chords; different names have been given them, (which may be seen at the word ACCORD, in Rousseau's Dictionary). These names, by the persons who bestowed them, were thought to create and sanctify their distinctions; as if a difference in names could really produce a difference in the species.

M. Rameau in his Treatise of Harmony has shown, and M. d'Alembert in his Elements of Music has still more clearly evinced, that many of these pretendedly different chords were no more than inversions of one single chord. Thus the chord of the sixth is no more than the perfect chord of the third transferred to the bass; by adding a fifth, we shall have the chord of the sixth and fourth. Here there are three combinations of a chord, which only consists of three sounds; those which contain four sounds are susceptible of four combinations, since each of these sounds may be transferred to the bass. But in adding beneath this another bass which, under all the combinations of one and the same chord, always presents the fundamental sound; it is evident, that consonant chords are reduced to the number three, and the number of dissonant chords to four. Add to this all the chords by supposition, which may likewise be reduced to the same fundamentals, and you will find harmony brought to a degree of simplicity in which no person could ever hope to see it whilst its rules remained in that state of confusion where M. Rameau found them. It is certainly, as that author observes, an astonishing occurrence, that the practice of this art could be carried so far as it really was, without knowing its foundation; and that all the rules were so exactly found, without having discovered the principle on which they depended.

After having shown what is the fundamental bass beneath the chords, let us now speak of its procedure, and of the manner in which it connects these chords among themselves. Upon this point the precept of the art may be reduced to the six following rules.

1. The fundamental bass ought never to sound any other notes than those of the series or tone in which the composer finds himself, or at least those of the series or tone to which he chooses to make a transition. This of all the rules for the fundamental bass is the first and most indispensable.

2. By the second, its procedure ought to be so implicitly subjected to the laws of modulation, as never to suffer the idea of a former mode to be lost till that of a subsequent one can be legitimately assumed; that is to say, that the fundamental bass ought never to be devious, or suffer us to be one moment at a loss in what mode we are.

3. By the third, it is subjected to the connexion of chords and the preparation of dissonances: a manœuvre, which, as we shall afterwards see, is nothing else but a method of producing this connexion, and which of consequence is only necessary when the connexion cannot subsist without it. See CONNEXION, PREPARATION.

4. By the fourth, it is necessitated, after every dissonance,

Fundamental. sonance, to pursue that career which the resolution of the dissonance indispensably prescribes. See RESOLUTION.

5. By the fifth, which is nothing else but a consequence of the former, the fundamental bass ought only to move by consonant intervals; except alone in the operation of a broken cadence, or after a chord of the seventh diminished, where it rises diatonically. Every other motion of the fundamental bass is illegitimate.

6. By the sixth, in short, the fundamental bass or harmony ought not to be syncopated; but to distinguish the bars and the times which they contain, by changes of chords properly marked with cadences; in such a manner, for instance, that the dissonances which ought to be prepared may find their preparation in the imperfect time, but chiefly that all the reposes may happen in the perfect time. This sixth rule admits of an infinite number of exceptions; but the composer ought however to be attentive to it, if he would form a music in which the movements are properly marked, and in which the bars may end gracefully.

Wherever these rules are observed, the harmony shall be regular and without fault: this, however, will not hinder the music from being detestable. See COMPOSITION.

A word of illustration on the fifth rule may not be useless. Whatever turn may be given to a fundamental bass, if it is properly formed, one of these alternatives must always be found; either perfect chords moving by consonant intervals, without which these chords would have no connexion; or dissonant chords in operations of cadence: in every other case, the dissonance can neither be properly placed nor properly resolved.

From thence it follows, that the fundamental bass cannot move regularly but in one of these three manners: 1st, To rise or descend by a third or by a sixth. 2dly, By a fourth or a fifth. 3dly, To rise diatonically by means of the dissonance which forms the connexion, or by a license upon a perfect chord. With respect to a diatonic descent, it is a motion absolutely prohibited to the fundamental bass; or, at most, merely tolerated in cases where two perfect chords are in succession, divided by a close expressed or understood. This rule has no other exception: and it is from not discerning the foundation of certain transitions, that M. Rameau has caused the fundamental bass to descend diatonically under chords of the seventh; an operation which is impracticable in legitimate harmony. See CADENCE, DISSONANCE.

The fundamental bass, which they add for no other reason than to serve as a proof of the harmony, must be retrenched in execution, and often in practice it would have a very bad effect; for it is, as M. Rameau very properly observes, intended for the judgment, and not for the ear. It would at least produce a monotony extremely nauseous by frequent returns of the same chord, which they disguise and vary more agreeably by combining it in different manners upon the continued bass, without reckoning upon the different inversions of harmony, which furnish a thousand means of adding new beauties to the music and new energy to the expression. See CHORD, INVERSION.

But it will be objected, If the fundamental bass is not useful in composing good music, if it must even be retrenched in practice, what good purpose, then, can it serve? We answer, that, in the first place, It serves for a rule to scholars, upon which they may learn to form a regular harmony, and to give to all the parts such a diatonic and elementary procedure as is prescribed them by that fundamental bass. It does more, as we have already said: it proves whether a harmony already formed be just and regular; for all harmony which cannot be subjected to the test of a fundamental bass, must according to all rules be bad. Finally, It serves for the investigation of a continued bass under a given air: though, in reality, he who cannot directly form a continued bass will scarcely be able to form a fundamental bass, which is better; and much less still will he be able to transform that fundamental bass into a legitimate continued bass. These which follow are, however, the principal rules which M. Rameau prescribes for finding the fundamental bass of a given air.

1. To ascertain with precision the mode in which the composer begins, and those through which he passes. There are also rules for investigating the modes; but so long, so vague, so incomplete, that with respect to this, the ear may be formed long before the rules are acquired; and the dunce who should try to use them would gain no improvement but the habit of proceeding always note by note, without even knowing where he is.

2. To try in succession under each note the principal chords of the mode, beginning by those which are most analogous, and passing even to the most remote, when the composer sees himself under a necessity of doing so.

3. To consider whether the chord chosen can suit the upper part in what precedes and in what follows, by a just fundamental succession; and when this is impracticable, to return the way he came.

4. Not to change the note of the fundamental bass till after having exhausted all the notes which are allowed in succession in the upper part, and which can enter into its chord; or till some syncopated note in the air may be susceptible of two or a greater number of notes in the bass, to prepare the dissonance which may be afterwards resolved according to rule.

5. To study the intertexture of the phrases; the possible succession of cadences, whether full or avoided; and above all, the pauses which for ordinary return at the end of every four, or of every two bars, so that they may always fall upon perfect and regular cadences.

6. In short, to observe all the rules formerly given for the composition of the fundamental bass.—These are the principal observations to be made for finding one under any given air; for there are sometimes several different ones which may be investigated. But, whatever may be said to the contrary, if the air has accent and character, there is only one just fundamental bass which can be adapted to it.

After having given a summary explication of the manner in which a fundamental bass should be composed, it should remain to suggest the means of transforming it into a continued bass; and this would be easy, if it were only necessary to regard the diatonic procedure and the agreeable air of this bass. But let us not imagine that the bass, which is the guide and support of the harmony, the soul, and as it were the interpreter of the air, should be limited to rules so simple: there are others which depend upon principles more certain and more radical; fruitful, but latent principles, which have been felt by every artist of genius, without having been detected by any one. Rousseau hopes, that in his letter upon French music he insinuated this principle. For those who understand him, he imagines he has said enough concerning it, and can never say enough of it for those who do not. See *Rousseau's Miscellanies*, vol. ii. p. 1.

He does not here mention the ingenious system by M. Serre of Geneva, nor his double fundamental bass; because the principles which, with a sagacity meritorious of praise, he had half detected, have afterwards been unfolded by M. Tartini, in a work of which Rousseau has given an account in his article SYSTEM.

FUNDI, in *Ancient Geography*, a town of Latium, on the Via Appia, near Cajeta; enjoying all the privileges of Roman citizens, except the right of suffrage and of magistracy. Now *Fondi;* a city of Naples, on the confines of the pope's dominions. E. Long. 14. 20. N. Lat. 41. 35.

FUNDY, a bay of considerable extent in North America, opening between the islands of Penobscot bay, in the county of Lincoln, and Cape Sable, the south-west point of Nova Scotia. It reaches about 200 miles in a north-east direction, and forms a very narrow isthmus with Verte bay, which reaches into the land in a south-west direction from the straits of Northumberland. It is 12 leagues from St John's in New Brunswick, to the Gut of Annapolis in Nova Scotia, where the tides are remarkably rapid, and rise to the height of 30 feet. The tides in this bay are so rapid, that it is said, they will overtake animals feeding on the shore.

FUNEN, or FIONIA, a considerable island in Denmark, seated in the Baltic sea, and separated from Jutland by a strait called the *Lesser Belt*, and from the island of Zealand by another called the *Great Belt*. It is fertile in wheat and barley; and abounds in cattle, horses, game of all sorts, and fish. Odensee is the capital town.

FUNERAL RITES, ceremonies accompanying the interment or burial of any person. The word is formed of the Latin *funus;* and that of *funalia*, on account of the torches (which were *funes cera circumdati*) used in the funerals of the Romans; though others derive *funus* from the Greek, φονος, *death* or *slaughter*.

These rites differed among the ancients according to the different genius and religion of each country.

The first people who seem to have paid any particular respect to their dead, were the Egyptians, the posterity of Ham, the first cultivators of idolatrous worship and superstition after the flood: they were also the first who asserted the immortality of the soul, its migration into all kinds of animals in earth, air, and sea, and its return to the human body; which they supposed to be within the term of 3000 years: Hence proceeded their very great care in embalming of their dead bodies, and their being at such vast expences, as they were, in building proper repositories for them; for they were more solicitous about their graves than their houses: This gave birth to those wonders of the world, the pyramids, which were built for the burial of their kings, with such vast charges, and almost incredible magnificence. See PYRAMID.

Whenever a person died among the *Egyptians*, his parents and friends put on mournful habits, and abstained from all banquets and entertainments. This mourning lasted from 40 to 70 days, during which time they embalmed the body. See EMBALMING.

When this ceremony was finished, the embalmed body was restored to the friends, who placed it in a kind of open chest, which was preserved either in their houses, or in the sepulchres of their ancestors. But before the dead were allowed to be deposited in the tomb, they underwent a solemn judgment, which extended even to their kings. Of this remarkable custom we have a particular account in the first book of Diodorus Siculus. "Those who prepare to bury a relation, give notice of the day intended for the ceremony to the judges, and to all the friends of the deceased; informing them, that the body will pass over the lake of that district to which the dead belonged: when, on the judges assembling, to the number of more than 40, and ranging themselves in a semicircle on the farther side of the lake, the vessel is set afloat, which those who superintend the funeral have prepared for this purpose. This vessel is managed by a pilot, called in the Egyptian language Charon; and hence they say, that Orpheus, travelling in old times into Egypt, and seeing this ceremony, formed his fable of the infernal regions, partly from what he saw, and partly from invention. The vessel being launched on the lake, before the coffin which contains the body is put on board, the law permits all, who are so inclined, to produce an accusation against it. If any one steps forth, and proves that the deceased has led an evil life, the judges pronounce sentence, and the body is precluded from burial; but if the accuser is convicted of injustice in his charge, he falls himself under a considerable penalty. When no accuser appears, or when the accusation is proved to be an unfair one, the relations, who are assembled, change their expressions of sorrow into encomiums on the dead, yet do not, like the Greeks, speak in honour of his family, because they consider all Egyptians as equally well born: but they set forth the education and manners of his youth, his piety and justice in maturer life, his moderation, and every virtue by which he was distinguished; and they supplicate the infernal deities to receive him as an associate among the blest. The multitude join their acclamations of applause in this celebration of the dead, whom they consider as going to pass an eternity among the just below." Such is the description which Diodorus gives of this funeral judicature, to which even the kings of Egypt were subject. The same author asserts, that many sovereigns had been thus judicially deprived of the honours of burial by the indignation of their people: and that the terrors of such a fate had the most salutary influence on the virtue of their kings.

The funeral rites among the *Hebrews* were solemn and magnificent. When any person was dead, his relations and friends rent their clothes; which custom is but faintly imitated by the modern Jews, who only cut off a bit of their garment, in token of affliction. It was usual to bend the dead person's thumb into the hand, and fasten it in that posture with a string; be-

cause

Funeral. cause the thumb then having the figure of the name of God, they thought the devil would not dare to approach it. When they came to the burying place, they made a speech to the dead in the following terms: "Blessed be God, who has formed thee, fed thee, maintained thee, and taken away thy life. O dead! he knows your numbers, and shall one day restore your life," &c. Then they spoke the elogium, or funeral oration, of the deceased; after which they said a prayer, called the *righteousness of judgment;* then turning the face of the deceased towards heaven, they called out, "Go in peace."

Among the ancient *Greeks* it was usual sometimes before the interment, to put a piece of money into the mouth of the deceased, which was thought to be Charon's fare for wafting the departed soul over the infernal river. This ceremony was not used in those countries which were supposed to be situated in the neighbourhood of the infernal regions, and to lead thither by a ready and direct road. The corpse was likewise furnished with a cake, composed of flour, honey, &c. which was designed to appease the fury of Cerberus the door-keeper of hell, and to procure the ghost a safe and quiet entrance. During the time the corpse continued in the house, there stood before the door a vessel of water: the design of which was, that those concerned about the body might purify themselves by washing; it being the opinion of the Greeks, as well as of the Jews, that pollution was contracted by touching a dead body.

The ceremonies by which they expressed their sorrow for the death of their friends were various; but it seems to have been a constant rule to recede as much as possible in habit and behaviour from their ordinary customs. For this reason they abstained from banquets and entertainments; they divested themselves of all ornaments; they tore, cut off, or shaved their hair, which they cast into the funeral pile, to be consumed with the body of their deceased friend. Sometimes they threw themselves on the ground and rolled in the dust, or covered their heads with ashes; they beat their breasts, and even tore their flesh with their nails, upon the loss of a person they much lamented. When persons of rank, such as public magistrates or great generals, died, the whole city put on a face of mourning: all public meetings were intermitted; the schools, baths, shops, temples, and all places of concourse, were shut up.

After interment followed the *epulæ* or feasts, at which the company used to appear crowned; when they spoke in praise of the dead, so far as they could go with truth, it being esteemed a notorious wickedness to lie upon such an occasion. And not only at those feasts, but even before the company departed from the sepulchre, they were sometimes entertained with a panegyric upon the dead person.

The Grecian soldiers, who died in war, had not only their tombs adorned with inscriptions showing their names, parentage, and exploits, but were also honoured with an oration in their praise. Particularly the custom among the Athenians in the interment of their soldiers was as follows, namely, "They used to place the bodies of their dead in tents three days before the funeral, that all persons might have opportunity to find out their relations, and pay their last respects to them. Upon the fourth day, a coffin of cypress was sent from every tribe, to convey the bones of their own relations; after which went a covered herse, in memory of those whose bodies could not be found. All these, accompanied by the whole body of the people, were carried to the public burying place, called *Ceramicus*, and there interred. One oration was spoken in commendation of them all, and their monuments were adorned with pillars, inscriptions, and all other ornaments usual about the tombs of the most honourable persons. The oration was pronounced by the fathers of the deceased persons who had behaved themselves most valiantly. Thus after the famous battle at Marathon, the fathers of Callimachus and Cynægyrus were appointed to make the funeral oration. And upon the return of the day upon which the solemnity was first held, the same oration was constantly repeated every year."

Interring or laying the dead in the ground seems to have been the most ancient practice among the Greeks; though burning came afterwards to be generally used among them. It was customary to throw into the funeral pile those garments the deceased usually wore. The pile was lighted by one of the deceased's nearest relations or friends, who made prayers and vows to the wind to assist the flames, that the body might quickly be reduced to ashes; and during the time the pile was burning, the dead person's friends stood by it, pouring libations of wine, and calling upon the deceased.

The funeral rites among the *ancient Romans* were very numerous. The deceased was kept seven days; and every day washed with hot water, and sometimes with oil, that, in case he was only in a slumber, he might be thus waked; and every now and then his friends meeting, made a horrible outcry or shout, with the same view; which last action they called *conclamatio*. The third conclamation was on the seventh day; when, if no signs of life appeared, the defunct was dressed and embalmed by the pollinctores; placed in a bed near the door, with his face and heels towards the street; and the outside of the gate, if the deceased were of condition, was garnished with cypress boughs. In the course of these seven days, an altar was raised near his bed side, called *acerra;* on which his friends every day offered incense: and the libitinarii provided things for the funeral.

On the seventh day a crier was sent about the city, to invite the people to the solemnization of the funeral in these words: *Exequias L. Tit. filii, quibus est commodum ire, jam tempus est. Olus* (i. e. *ille*) *ex ædibus effertur*. The people being assembled, the last conclamation ended, and the bed was covered with purple: a trumpeter marched forth, followed by old women called *præficæ*, singing songs in praise of the deceased: lastly, the bed followed, borne by the next relations; and if the person were of quality and office, the waxen images of all his predecessors were carried before him on poles. The bed was followed by his children, kindred, &c. *atrati*, or in mourning: from which act of following the corpse, these funeral rites were called *exequiæ*. The body thus brought to the rostra, the next of kin *laudabat defunctum pro rostris*, made a funeral oration in his praise and that of his ancestors. This done, the body was carried to the *pyra*, or funeral pile, and there burnt: his friends first cutting off a finger, to be buried

Funeral. ried with a second solemnity. The body consumed, the ashes were gathered; and the priest sprinkling the company thrice with clean water, the eldest of the *præficæ* crying aloud, *Ilicet*, dismissed the people, who took their leave of the deceased in this form, *Vale, vale, vale: nos te ordine quo natura permiserit sequemur.*—The ashes, enclosed in an urn, were laid in the sepulchre or tomb.

The *ancient Christians* testified their abhorrence of the Pagan custom of burning their dead; and always deposited the body entire in the ground: and it was usual to bestow the honour of embalming upon the martyrs at least, if not upon others. They prepared the body for burial by washing it with water, and dressing it in a funeral attire. The exportation or carrying forth of the body was performed by near relations, or persons of such dignity as the circumstances of the deceased required. Psalmody, or singing of psalms, was the great ceremony used in all funeral processions among the ancient Christians.

In the *Romish church*, when a person is dead, they wash the body, and put a crucifix in its hand. At its feet stands a vessel full of holy water, and a sprinkler, that they who come in may sprinkle both themselves and the deceased. In the mean time some priest stands by the corpse, and prays for the deceased till it is laid in the earth. In the funeral procession, the exorcist walks first, carrying the holy water; next the cross-bearer, afterwards the rest of the clergy, and last of all the officiating priest. They all sing the *miserere*, and some other psalms; and at the end of each psalm a *requiem*. We learn from Alet's ritual, that the faces of deceased laymen must be turned towards the altar, when they are placed in the church; and those of the clergy towards the people. The corpse is placed in the church surrounded with lighted tapers; after the office for the dead, mass is said; then the officiating priest sprinkles the corpse thrice with holy water, and as often throws incense on it. The body being laid in the grave, the friends and relations of the deceased sprinkle the grave with holy water.

The funeral ceremonies of the *Greek church* are much the same with those of the Latin. It needs only be observed, that, after the funeral service, they kiss the crucifix, and salute the mouth and forehead of the deceased; after which each of the company eats a bit of bread and drinks a glass of wine in the church, wishing the soul a good repose, and the afflicted family all consolation.

Funeral Games, a part of the ceremony of the ancient funerals.

It was customary for persons of quality among the ancient Greeks and Romans, to institute games with all sorts of exercises, to render the death of their friends more remarkable. This practice was generally received, and is frequently mentioned by ancient writers. Patroclus's funeral games take up the greatest part of one of Homer's Iliads; and Agamemnon's ghost is introduced by the same poet, telling the ghost of Achilles, that he had been a spectator at a great number of such solemnities.

The celebration of these games among the Greeks mostly consisted of horse races; the prizes were of different sorts and value, according to the quality and magnificence of the person that celebrated them. The garlands given to victors on this occasion were usually of parsley, which was thought to have some relation to the dead. Funeral.

Those games, among the Romans, consisted chiefly of processions; and sometimes of mortal combats of gladiators around the funeral pile. They, as well as the Greeks, had also a custom, though very ancient, of cutting the throats of a number of captives before the pile, as victims to appease the manes of the deceased. Cæsar relates, that the Gauls had this custom.

The funeral games were abolished by the emperor Claudius.

Funeral Oration, a discourse pronounced in praise of a person deceased, at the ceremony of his funeral.

This custom is very ancient. In the latter part of the account above given of the Egyptian ceremonies of interment, may be perceived the first rudiments of funeral orations, and what was the subject of them, which were afterwards moulded into a more polite and regular form by other nations, who adopted this custom. Nor can we omit remarking, that those funeral solemnities were attended not only with orations in praise of the deceased, but with prayers for him: which prayers, it seems, were made by one who personated the deceased: an entire form of one of them is preserved by Porphyry, and perhaps it may in some measure gratify the reader's curiosity to recite it from him. "When (says he) they (the Egyptians) embalm their deceased nobles, they privately take out the entrails, and lay them up in an ark or chest: moreover, among other things which they do in favour of the deceased, lifting up the ark or chest to the sun, they invoke him; one of the *libitinarii* making a prayer for the deceased, which Euphantes has translated out of the Egyptian language, and is as follows:—O lord, the sun, and all the gods who give life to men, receive me and admit me into the society of the immortal ones; for, as long as I lived in this world, I religiously worshipped the gods whom my parents showed me, and have always honoured those who begat my body; nor have I killed any man, nor have I defrauded any of what has been committed to my trust, nor have I done any thing which is inexpiable. Indeed, whilst I was alive, if I have sinned either by eating or drinking any thing which was not lawful; not through myself have I sinned, but through these, showing the ark and chest where the entrails were. And having thus spoke, he casts it into the river, but the rest of the body he embalms as pure."

The Grecians received the seeds of superstition and idolatrous worship from the Egyptians, through the coming of Cecrops, Cadmus, Danaus, and Erechtheus, into Greece; and among other customs transplanted from Egypt, were the solemnities used at the burial of the dead. Of these, an encomium on the deceased always formed a part, as particularly noticed under the preceding article.

From the Egyptians and Grecians, especially from the latter, the Romans received many of their laws and customs, as well as much of their polytheism and idolatrous worship. It is well known, that the custom of making funeral orations in praise of the dead obtained among them; and the manner in which their funeral services were performed has been already described. The corpse being brought into their great oratory, Funeral. oratory, called the *rostra*, the next of the kin *laudabat defunctum pro rostris*, that is, made a funeral oration, in the commendation principally of the party deceased, but touching the worthy acts also of those his predecessors whose images were there present. The account given by Dr Kennet is in these words: "In all the funerals of note, especially in the public or indictive, the corpse was first brought with a vast train of followers into the forum; here one of the nearest relations ascended the rostra, and obliged the audience with an oration in praise of the deceased. If none of the kindred undertook the office, it was discharged by some of the most eminent persons in the city for learning and eloquence, as Appian reports of the funeral of Sylla. And Pliny the younger reckons it as the last addition to the happiness of a very great man, that he had the honour to be praised at his funeral by the most eloquent Tacitus, then consul; which is agreeable to Quintilian's account of this matter, *Nam et funebres*, &c. For the funeral orations (says he) depend very often on some public office, and by order of senate are many times given in charge to the magistrates to be performed by themselves in person. The invention of this custom is generally attributed to Valerius Poplicola, soon after the expulsion of the regal family. Plutarch tells us, that honouring his colleague's obsequies with a funeral oration, it so pleased the Romans, that it became customary for the best men to celebrate the funerals of great persons with speeches in their commendations." Thus Julius Cæsar, according to custom, made an oration in the rostra, in praise of his wife Cornelia, and his aunt Julia, when dead; wherein he showed, that his aunt's descent, by her mother's side, was from kings, and by her father's from the gods. Plutarch says, that "he approved of the law of the Romans, which ordered suitable praises to be given to women as well as to men after death."—Though by what he says in another place, it seems that the old Roman law was, that funeral orations should be made only for the elder women; and therefore he says, that Cæsar was the first that made one upon his own wife, it not being then usual to take notice of younger women in that way: but by that action he gained much favour from the populace, who afterwards looked upon him, and loved him, as a very mild and good man. The reason why such a law was made in favour of the women, Livy tells us was this, That when there was such a scarcity of money in the public treasury, that the sum agreed upon to give the Gauls to break up the siege of the city and capitol could not be raised, the women collected among themselves and made it up; who hereupon had not only thanks given them, but this additional honour, that after death, they should be solemnly praised as well as the men: which looks as if, before this time, only the men had those funeral orations made for them.

This custom of the Romans very early obtained among the Christians. Some of their funeral sermons or orations are now extant, as that of Eusebius on Constantine; and those of Nazianzen on Basil and Cæsarius; and of Ambrose on Valentinian, Theodosius, and others. Gregory, the brother of Basil, made επικηδειον λογον, a funeral oration, for Melitus bishop of Antioch: in which orations, they not only praised the dead, but addressed themselves to them, which seems Funeral Fungi. to have introduced the custom of praying to departed saints. Now these orations were usually made before the bodies of the deceased were committed to the ground; which custom has been more or less continued ever since, to this day.

Thus it appears, that those rites and ceremonies among the heathens, which have been delivered from one people to another, are what have given birth to

FUNERAL Sermons and Orations, among Christians. Though this practice is considerably improved, and cleared of many things which would smell too rank of paganism, and is thrown into a method which, perhaps, may be of some service to Christianity; yet, notwithstanding this new dress, its original may very easily be discerned. The method in which the characters of deceased persons are given in our funeral sermons, is very much the same with that observed in those pagan orations; where first an account is given of the parentage of the deceased, then of his education; after that, we hear of his conduct in riper years: then his many virtues are reckoned up, with his generous, noble, and excellent performances.—Nor let the practice be condemned because of its rise and original; for why may not the customs of heathens, if just and laudable in themselves, and nowise pernicious to Christianity in their consequences, be followed by Christians? Only, since we are come into this practice, there is one thing we should take care to follow them in; and that is, not to make those sermons or orations for every one; but for those only whose characters are distinguished, who have been eminently useful in the world, and in the church of Christ. The old heathens honoured those alone with this part of the funeral solemnity, who were men of probity and justice, renowned for their wisdom and knowledge, or famous for warlike exploits: This, as Cicero* informs us, being part of the law for burials, which directs, that the praises only of honourable persons shall be mentioned in the oration. It would be much more agreeable, therefore, if our funeral discourses were not so common, and if the characters given of the deceased were more just; devoid of that fulsome flattery with which they too often abound.

* De Leg. l. 2.

FUNGI (from σφογγος, *fungus*), the name of the 4th order of the 24th class of vegetables, in the Linnæan system; comprehending all those which are of the mushroom kind, and which in Tournefort constitute the 2d, 3d, 4th, 5th, 6th, 7th, and 8th genera of the first section in the class XVII. This order in the Linnæan arrangement, contains 10 genera; and it constitutes one of the natural order of plants in the *Fragmenta Methodi Naturalis* of Linnæus. See BOTANY *Index*.

But as the classification of this order only has been given under the article BOTANY, we shall here detail some of the speculations of naturalists concerning their nature and mode of production.

The ancients called fungi *children of the earth*, meaning, no doubt, to indicate the obscurity of their origin. The moderns have likewise been at a loss in what rank to place them; some referring them to the animal, some to the vegetable, and others to the mineral kingdom.

Messrs Wilck and Munchausen have not scrupled to rank these bodies in the number of animal productions; because,

because, when fragments of them or their seeds were macerated in water, these gentlemen perceived a quantity of animalcules discharged, which they supposed capable of being changed into the same substance. It was the ancient opinion, that beef could produce bees; but it was reserved for Messrs Wilck and Munchausen to suppose, that bees could produce beef. Wilck asserts, that fungi consist of innumerable cavities, each inhabited by a polype; and he does not hesitate to ascribe the formation of them to their inhabitants, in the same way as it has been said that the coral, the lichen, and the mucor, were formed. Hedwig has lately shown how ill founded this opinion is with respect to the lichen; and M. Durande has demonstrated its falsity with regard to the corallines. "Indeed (says M. Bonnet, talking of the animality of fungi) nothing but the rage for paradox could induce any one to publish such a fable; and I regret that posterity will be able to reproach our times with it. Observation and experiment should enable us to overcome the prejudices of modern philosophy; now, that those of the ancient have disappeared and are forgotten."

It cannot be denied that the mushroom is one of the most perishable of all plants, and it is therefore the most favourable for the generation of insects. Considering the quickness of its growth, it must be furnished with the power of copious absorption; the extremity of its vessels must be more dilated than in other plants. Its root seems, in many cases, to be merely intended for its support: for some species grow upon stones or moveable sand, from which it is impossible that they can draw much nourishment. We must therefore suppose, that it is chiefly by the stalk that they absorb. These stalks grow in a moist and tainted air, in which float multitudes of eggs, so small, that the very insects they produce are with difficulty seen by the microscope. These eggs may be compared to the particles of the byssus, 100,000 of which, as M. Gleditsch says, are not equal to the fourth of a grain. May we not snppose, that a quantity of such eggs are absorbed by the vessels of the fungus, that they remain there, without any change, till the plant begins to decay? Besides, the eggs may be only deposited on the surface of the plant, or they may exist in the water into which they are thrown for examination. Do not we see that such eggs, dispersed through the air, are hatched in vinegar, in paste, &c. and wherever they find a convenient nidus for their developement? Can it be surprising then, that the corruption of the mushroom should make the water capable of disclosing certain beings that are really foreign to both?

It is not more easy to acquiesce in the opinions of those naturalists who place the fungi in the mineral kingdom, because they are found growing on porous stones, thence called *lapides fungarii*; which, however, must be covered with a little earth, and be watered with tepid water, in order to favour the growth. Such mushrooms are no more the produce of the stone, than the lichen is of the rock to which it adheres, or the moss of the tree on which it is found. We have only to observe the growth of mushrooms, to be convinced, that this happens by developement, and not by addition or combination of parts as in minerals. The opinion of Boccone, who attributed them to an unctuous matter performing the function of seed, and acquiring extension by apposition of similar parts; and that of Morison, who conceived that they grew spontaneously out of the earth by a certain mixture of salt and sulphur, joined with oils from the dung of quadrupeds; have now no longer any adherents. Fungi are produced, they live, they grow, by developement; they are exposed to those vicissitudes natural to the different periods of life which characterize living substances; they perish and die. They extract, by the extremity of their vessels, the juices with which they are nourished: they elaborate and assimilate them to their own substance. They are, therefore, organized and living beings, and consequently belong to the vegetable kingdom. But whether they are real plants, or only the production of plants, is still a matter in dispute with the ablest naturalists.

Some ancient authors have pretended to discover the seed of mushrooms; but the opinion was never generally received. Petronius, when he is laughing at the ridiculous magnificence of his hero Trimalcio, relates, that he had written to the Indies for the seed of the morelle.

These productions were generally attributed to the superfluous humidity of rotten wood, or other putrid substances. The opinion took its rise from observing that they grew most copiously in rainy weather. Such was the opinion of Tragus, of Bauhin, and even of Columna, who, talking of the peziza, says, that its substance was more solid and harder, because it did not originate from rotten wood, but from the *pituita* of the earth. It is not surprising, that, in times when the want of experiment and observation made people believe that insects could be generated by putrefaction, we should find the opinion general, that fungi owed their origin to the putrescence of bodies, or to a viscous humour analogous to putridity.

Malpighi could not satisfy himself as to the existence of seeds which other botanists had pretended to discover. He only says, that these plants must have them, or that they perpetuate themselves and shoot by fragments. Micheli, among the moderns, appears to have employed himself most successfully on this subject. He imagined, that he not only saw the seeds, but even the stamina, as well as the little transparent bodies destined to favour the dissemination and the fecundation of these seeds. Before this author, Lister thought he perceived seeds in the *Fungus perosus crassus magnus* of John Bauhin: the little round bodies that are found in the pezizæ and hevellæ, at that time passed for seeds; which did not appear at all probable to Marsigli, considering that the eye, when assisted with the very best microscopes, could perceive nothing similar in much larger fungi. Indeed these bodies may be the capsules or covers of the seeds, if they are not the seeds themselves. However this may be, Marsigli, observing that fungi were often without roots or branches, and that they wanted flowers and seeds, the means which nature employs for the production of perfect plants, thought himself warranted in doubting whether these beings could be ranked in the number of vegetables.

The doubts of Marsigli prompted him to observe the formation of fungi. Their matrix he called *Situs:* he imagined they grew in places where they met with an unctuous matter, composed of an oil mixed with nitrous salt, which, by fermentation, produced heat and mois-

Fungi. ture, and insinuated itself between the fibres of wood; that is, he imagined them to be the production of a viscous and putrescent humour. Lancisi, in like manner, considered fungi as owing their existence to the putrefaction of vegetables, and supposed them a disease in the plant; but he imagined, "that the fibres of the tree were necessary to their production," as is the case in the formation of galls; he compared them to the warts and other excrescences of the human body. He added, that such fungous vegetable tumours must necessarily assume various forms and figures, from the fluids which distend the tubes and vessels relaxed by putrescence, from the ductility of the fibres and their direction, and from the action of the air.

This opinion has been refuted by the celebrated naturalist M. de Jussieu, in the Memoirs of the Academy of Sciences for the year 1728. He maintains, that the fungi have a great analogy with the lichen, which is allowed to be a vegetable; that, like the lichen, they are divested of stalk, branches, and leaves; that, like it, they grow and are nourished upon the trunks of trees, on pieces of rotten wood, and on all sorts of putrid vegetables; that they resemble the lichen too in the rapidity of their growth, and the facility with which many of them may be dried, and restored to their former figure upon being immersed in water; and, lastly, that there is a great similarity in the manner in which their seeds are produced. He affirms, that only the warts and excrescences which grow on animal bodies, and the knots and other tumours that are to be found on trees, can be compared with one another; for they are composed equally of the solid and liquid substance of the plant or animal on which they grow; whereas, the matter of the fungi is not only quite distinct from that of the plants on which they are found, but often entirely similar to the substance of those that spring immediately from the earth.

The organization, says M. de Jussieu, which distinguishes plants and other productions of nature, is visible in the fungi; and the particular organization of each species is constant at all times and in all places; a circumstance which could not happen if there were not an animal reproduction of species, and consequently a multiplication and propagation by seed. This is not, he says, an imaginary supposition; for the seeds may be felt like meal upon mushrooms with gills, especially when they begin to decay; they may be seen with a magnifying glass, in those that have gills with black margins; and lastly, says he, botanists can have no doubt that fungi are a distinct class of plants, because, by comparing the observations made in different countries with the figures and the descriptions of such as have been engraven, the same genera and the same species are everywhere found.

Notwithstanding this refutation by M. de Jussieu, another naturalist, M. de Necker, has lately maintained, in his work entitled *Mycitologia*, That the fungi ought to be excluded from the three kingdoms of nature, and be considered as intermediate beings. He has observed, like Marsigli, the matrix of the fungi: and has substituted the word *carchte* (initium faciens) instead of *situs*; imagining that the rudiment of the fungus cannot exist beyond that point in which the developement of the filaments or fibrous roots is perceived. He allows, that fungi are nourished and grow like vegetables; but he thinks that they differ very much from them in respect of their origin, structure, nutrition, and rapidity of growth. He says, that the various vessels which compose the organization of vegetables are not to be found in the fungi, and that they seem entirely composed of cellular substance and bark; so that this simple organization is nothing more than an aggregation of vessels endowed with a common nature, that suck up the moisture in the manner of a sponge; with this difference, that the moisture is assimilated into a part of the fungus. Lastly, That the fructification, the only essential part of a vegetable, and which distinguishes it from all other organized bodies, being wanting, fungi cannot be considered as plants. This he thinks confirmed by the constant observation of those people who gather the morelle and the mushroom, and who never find them in the same spots where they had formerly grown. As the generation of fungi (says M. Necker) is always performed when the parenchymatous or cellular substance has changed its nature, form, and function, we must conclude that it is the degeneration of that part which produces these bodies.

But if fungi were owing merely to the degeneration of plants, they would be still better entitled to constitute a new kingdom. They would then be a decomposition, not a new formation or new bodies. Besides, we cannot deny, that in those bodies which form the limit between the animal and vegetable kingdoms, the organization becomes simple, as the organs destined for nutrition are multiplied: but, as the last in the class of insects belongs to the animal kingdom, fungi ought, notwithstanding the simplicity of their organization, still to belong to the vegetable kingdom. The parenchymatous or cellular substance, which, as Mr Bonnet says, is universally extended, embraces the whole fibrous system, and becomes the principal instrument of growth, must naturally be more abundant in these productions; and this accounts for the rapidity of their enlargement. Besides, growth, whether slow or rapid, never was employed to determine the presence or absence of the vegetable or animal character. The *draba verna*, which in a few weeks shoots, puts forth its leaves, its flowers, and fruit, is not less a plant than the palm. The insect that exists but for a day, is as much an animal as the elephant that lives for centuries. As to the seeds of the fungi, it is probable that nature meant to withdraw from our eyes the dissemination of these plants, by making the seeds almost imperceptible; and it is likewise probable that naturalists have seen nothing but their capsules. Since, however, from the imperfection of our senses, we are unable to perceive these seeds, ought we to infer that they do not exist? Are we authorized to conclude this, because we do not find mushrooms where we have found them a year before? Undoubtedly not; for the greater part of plants require a particular soil, and the same mould that this year will foster a rare plant, will next year allow it to perish. Neither are we at liberty to deny the existence of these seeds, because those bodies which have been called their seeds, and the fragments or cuttings of the plants themselves, have not produced others of the same species. Nature seems to have reserved for herself the care of disseminating certain plants: It is in vain, for instance, that the botanist

nist sows the dust found in the capsules of the orchis, which every one allows to be the seed. But, after all, what are those parts in the fungi casually observed by naturalists, and which they have taken for the parts of fructification? These are quite distinct from the other parts; and whatever may be their use, they cannot have been formed by a prolongation of the cellular substance, or of the fibres of the tree on which the fungus grows: they are, therefore, owing, like flower and fruit, to the proper organization of the plant. These plants, therefore, have a particular existence, independent of their putrefying nidus. The gills of certain fungi, which differ essentially from the rest of the plant in their conformation, would be sufficient to authorize this latter opinion. But can putrefaction create an organic substance?

Nature undoubtedly disseminates through the air, and over the surface of the earth, innumerable seeds of fungi, as well as eggs of insects. The plant and the animal are excluded, when the nidus or the temperature is favourable for their developement. No fortuitous concourse, either of atoms or fluids, could produce bodies so exquisitely and so regularly organized. It is sufficient to throw one's eyes on the beautiful plates which Schæffer has published of them, and compare them, by the glass, with the warts and other excrescences of animals, to be convinced that they have not the same origin. The function of the cellular substance in vegetables must be greatly superior to that in animals, if it could produce any thing but deformities.

The greater part of fungi exhibit a configuration much too regular, constant, and uniform, to be the effect of chance or putrefaction. As this form is preserved the same in all places where fungi have been found, it follows, that they contain in themselves the principles of their reproduction. They resemble the misletoe, and other parasitic plants, which are perfectly distinct from the trees on which they grow. The fungi, therefore, are organized and living substances, or true plants. If the manner of their production is unknown, that of some insects is so too.

FUNGIBLES, in *Scots Law*, are such things as are estimated by number, weight, or measure; as coin, butter, ale, &c.

FUNGITÆ, in *Natural History*, a kind of fossil coral, of a conic figure, though sometimes flatted and striated longitudinally.

FUNGUS, in *Surgery*, denotes any spongy excrescence. See SURGERY *Index*.

FUNNEL *of a* CHIMNEY, the shaft or smallest part of the waste, where it is gathered into its least dimensions.

Palladio directs, that the funnels of chimneys be carried through the roof four or five feet at least, that they may carry the smoke clear from the house into the air. See CHIMNEY.

He also advises, that chamber chimneys be not made narrower than 10 or 11 inches, nor broader than 15; for if too narrow, the smoke will not be able to make its way; and, if too wide, the wind will drive it back into the room.

FUR, or FURR, in commerce. See FURR.

FURBISHER, a person who furbishes, polishes, or cleans arms, as guns, swords, pistols, &c. which is chiefly performed with emery. See the article EMERY.

FURCA, in antiquity, a piece of timber resembling a fork, used by the Romans as an instrument of punishment.

The punishment of the furca was of three kinds: the first only ignominious, when a master, for small offences, forced a servant to carry a furca on his shoulders about the city. The second was penal, when the party was led about the circus, or other place, with the furca upon his neck, and whipped all the way. The third was capital, when the malefactor having his head fastened on the furca, was whipped to death.

FURCHE', in *Heraldry*, a cross forked at the ends.

FURETIERE, ANTONY, an ingenious and learned Frenchman, was born at Paris in 1620; and after a liberal education became eminent in the civil and canon law. He was first an advocate in the parliament; and afterwards taking orders, was presented with the abbey of Chalivoy, and the priory of Chuines. Many works of literature recommended him to the public; but what he is chiefly known by and valued for is, his Universal Dictionary of the French Tongue, in which he explains the terms of art in all sciences. He had not, however, the pleasure of seeing this useful work published before his death; which happened in 1688. He was a member of the French academy; and the disputes and quarrels which he had with certain members of it made a great noise in the world.

FURIA, in *Zoology*, a genus of insects belonging to the order of vermes zoophyta. There is but one species, viz. the infernalis, which has a linear smooth body ciliated on each side, with reflexed feelers pressed to its body. In Finland, Bothnia, and the northern provinces of Sweden, it was not unfrequently that people were seized with a pungent pain, confined to a point, in the hand or other exposed part of the body, which presently increased to a most excruciating degree, and hath sometimes been suddenly fatal. This disorder was more particularly observed in Finland, especially about boggy and marshy places, and always in autumn. At length it was discovered that this pain instantly succeeded somewhat that dropped out of the air, and in a moment penetrated and buried itself in the flesh. The Finlanders had tried variety of applications to no purpose, until at length a poultice of curds or cheese was found the most effectual in easing the pain: and the event confirmed that the insect was allured by this application to leave the flesh; as, on its removal, this worm, no longer than the sixth of an inch, was found in it, and thus the cause of this painful disease explained. But by what means this creature is raised into the air, is as yet unknown.

FURIES, in Pagan antiquity, certain goddesses whose office it was to punish the guilty after death. They were three in number: Alecto, Megæra, and Tisiphone; who were described with snakes instead of hair, and eyes like lightning, carrying iron chains and whips in one hand, and in the other flaming torches; the latter to discover, and the former to punish, the guilty: and they were supposed to be constantly hovering over such persons as had been guilty of any enormous crime.

Mythologists suppose, that Tisiphone punished the crimes which sprang from hatred or anger; Megæra,

 those

those from envy; and Alecto, those from an insatiable pursuit after riches and pleasure.

FURLING, in naval affairs, signifies the operation of wrapping up and binding any sail close to the yard.

FURLONG, an English long measure containing the one-eighth of a mile, and therefore equal to 660 feet, or 220 yards.

FURLOUGH, in the military language, is a license granted by an officer to a soldier to be absent from his duty for a limited time.

FURNACE,

Furnace.

IS a vessel or building, for the purpose of containing combustible materials, whether of coal or wood, and so constructed that great heat may be produced and concentrated. There is a great variety of furnaces, and they are variously constructed, according to the views of the operator, and the purposes to which they are applied. But in all furnaces there are four things which require to be particularly attended to. 1. To be able to concentrate the heat, and direct it as much as possible to the substances which are to be acted upon. 2. To prevent the dissipation of the heat after it is produced. 3. To obtain the greatest quantity of heat from the smallest quantity of fuel; and, 4. To be able to regulate at pleasure the necessary degree of heat.

Requisites of a good furnace.

To concentrate the heat.

1. To accomplish the first object, namely to concentrate the heat, it is usual to confine the fire in a chamber or cavity properly constructed, furnished with a door or opening, by which the fuel is introduced; a grate for supporting it, and allowing a free passage to the air, as well as for the ashes to fall through into the cavity below, called the *ash-pit*. In this way the heat produced by the combustion of the fuel is confined by the sides of the furnace, and so concentrated that its force is chiefly spent on the substances inclosed.

To prevent its dissipation.

2. The dissipation of the heat is prevented by keeping the door of the furnace shut, by constructing the chimney no wider than to allow a passage for the smoke, and placing the substance to be acted upon in such a manner that the fire may have its full effect as it goes up the chimney.

To produce the greatest proportion of heat.

3. The third object, which is not the least important, is to produce the greatest quantity of heat from the smallest quantity of fuel. In an economical point of view, this object is worthy of the greatest attention, though it is often difficult to attain it. In this view much depends upon the proportion between the spaces between the bars of the furnace, and the wideness and height of the chimney. This is obvious from considering the circumstances which regulate the process of combustion; for this depends on the current of air passing through the combustible matter. When the fuel in the furnace is kindled, a certain degree of heat is produced; but without a current of fresh air passing through the burning matter, the fire is instantly extinguished; and without this stream of fresh air the inflammation cannot go on. But when this takes place, the air within the furnace is rarefied, and being no longer a balance for the external air, it is driven up the chimney by a current of denser air, rushing in at the openings. This having passed through the fuel, is also rarefied, and passes off, giving place in its turn to a new current, so that in this way there is a constant flux of air up the chimney. From this it must appear, that the greater the rarefaction of the air in the fire-place is, the greater will be the intensity of the heat produced. By constructing a furnace in a particular way, the heat may be so managed that the under part of the chimney may be nearly as strongly heated as the fire-place itself; so that, although a strong current of air passes through the fuel, yet as the heat is uselessly spent on the chimney, there is a great and unnecessary waste of fuel. To prevent this, there is a contrivance by which the throat of the chimney is occasionally contracted, by means of a sliding plate, which, when it is pushed in, closes up the whole vent; but may be drawn out in such a way as to form a larger or smaller opening as may be thought necessary. Till the fuel is thoroughly kindled, and the furnace fully heated, the plate should be quite drawn out, so that the largest column of air which the furnace will admit, may pass through the fuel. The plate is then put in to a certain length, and so regulated that the smoke may be prevented from issuing at the door of the furnace. The current of air increases in proportion to the rarefaction of the air in the fire-place, and this increases the inflammation of the fuel; and the heat now being reflected from every point of the furnace, excepting the narrow passage by which the smoke passes off, becomes extremely intense. If a large quantity of fuel be introduced at once, it will consume slowly, and require little attention, in comparison with those furnaces where this precaution is not observed. When the intensity of the heat is not very great, the sliding-plate may be of cast-iron; but to resist great degrees of heat, it will be found more convenient to have it made of fire-clay. But it must be observed, that the advantage derived from the sliding-plate is lost to those furnaces which are of a large construction, and where great quantities of metal are to be melted; and there it is commonly found, that the waste of fuel is very great.

Method of regulating the heat.

4. To attain the fourth object, namely, to be able to regulate conveniently the degree of heat, a certain proportion of air only is to be allowed to pass through the fuel. With this view it is necessary to have the command of the furnace below, because the parts above are often filled with small quantities of soot. To manage this in the most effectual manner, the door of the ash-pit is to be perfectly closed, and furnished with a series of round holes which have a certain proportion to each other. In the furnaces constructed according to Dr Black's direction, the areas of these holes are as 1, 2, 4, 8, 16, &c. in geometrical progression. Seven or eight of these in the door of the ash-pit give a sufficient command over the fire. When the utmost intensity of heat is required, all the passages are thrown open, and the height of the chimney is increased, so that the height of the column of rarefied air being augmented, the motion of the current of air through the fuel is proportionably more rapid, and consequently the heat of the furnace becomes more intense. In the construction of a furnace recommended by Macquer, another tube is applied to the ash-pit, having the extremity most

Furnace.

most distant from the furnace widest, and gradually tapering as it approaches it. By this contrivance, it was proposed to increase the velocity of the current of air as it passes from a wider into a narrower tube. But it is found that the air will not ultimately move with greater velocity than if the tube were not applied. It may indeed be useful where the furnace is placed in a small apartment, and the tube itself forms a communication with the external air.

After these preliminary observations on the general principles of furnaces, we propose in the following treatise to give a short account of the construction and application of some of the more important furnaces which are employed in the arts and manufactures.

But before we enter into the detail and description of particular furnaces, we shall lay before our readers the description of one which was invented by Messrs Robertons of Glasgow, for the purpose of consuming its own smoke, and saving fuel.

Furnace for consuming its own smoke.

"To construct furnaces (says the editor of the Philosophical Magazine, from which this account is taken), on such a principle as should enable them to consume their own smoke, has long been a desideratum; and we believe the public in general, but especially those who have been annoyed by the smoke of steam engines, founderies, and similar erections in their neighbourhood, will be glad to learn that a furnace has been contrived which effectually gains this end.

"The construction is extremely simple, and will be easily understood by the following description, and the plate to which it refers.

Plate CCXM. fig. 1. &c.

Fig. 1. represents a vertical section, and fig. 2. a front view of a steam-engine boiler, furnished with one of Messrs Robertons furnaces; and the same letters refer in both to the same parts of the construction.

"The opening A, through which the fuel is introduced into the furnace, is shaped somewhat like a hopper, and is made of cast iron built into the brick-work H, H. From the mouth it inclines downward to the place where the fire rests on the bottom grate B. The coals in this mouth piece or hopper answer the purpose of a door (A), and those that are lowest are by this means brought into a state of ignition before they are forced into the furnace. Below the lower plate of the hopper K, *e* the furnace is provided with front bars G (B), which not only serve to admit air among the fuel, but offer a ready way to force the fuel back, from time to time, from *c* to *d* (C), to make room for fresh quantities to fall into the furnace from the hopper or mouth-piece. By this arrangement the fuel is brought into a state of ignition before it reaches the farther side of the bottom grate, where it is stopped by the rising breast, *b*, of the brick-work, so that any smoke liberated from the raw coals in the mouth-piece, must pass over these burning coals before it can reach the flue FFF. But this, though it would cause a large quantity of the smoke to be burnt, would not completely prevent the escape and ascent of smoke up the chimney; for it is not merely necessary that the smoke should be exposed to a heat sufficient to ignite it before it escapes: unless, at the same time, a quantity of fresh air, able to furnish a sufficiency of oxygen for the combustion of the smoke, can be brought into contact with it, it will still escape in an undecomposed state. The judicious admission of fresh air, in such a manner that it can reach the smoke, without previously passing through the fire, and parting with its oxygen in its passage, and in such quantity as not to cool the bottom of the boiler, but merely to cause the smoke to burn, constitutes the chief merit of this invention; and to us it appears that it will fully answer the proposed end. Below the upper side of the mouth-piece or hopper, and at about the distance of three-fourths of an inch from it, (this space being a little more or less, according to the size of the furnace), is introduced a cast iron plate *a n*. This plate is above the fuel, and the space between it and the top of the hopper is open for the admission of a thin stream of air, which, rushing down the opening, comes first in contact with that part of the fire which is giving off the greatest part of the smoke, viz. the fuel that has been last introduced, mixes with it before it passes over the fuel in the interior, which is in a high state of combustion, and enables it to inflame so completely, that not a particle of smoke ever escapes undecomposed.

"The quantity of air thus admitted to pass over the upper surface of the fire, is regulated by a very simple contrivance. The plate *a n* rests at each end on a stud, or pin, projecting from the cheeks of the mouth-piece A, or is furnished at each end with a pivot which works in the cheeks; the said pins or pivots being placed about midway between the outside and inside of the mouth-piece or hopper, so that, by elevating or depressing the edge *a* of the plate, the opening at *n* is enlarged or diminished. When that degree of opening which produces the best effects are obtained, which is easily known, the plate *a n* is kept in its place by means of a piece of iron introduced above it, and answering the purpose of a wedge.

"Under the grates is the ash-hole I, the upper part of which is furnished with doors SS, which, when shut, prevent the heat from the front bars G from coming out into the apartment, and incommoding the workmen.

"Invited by an advertisement, we went to Messrs Bunnell

(A) "In the management of this furnace, what is chiefly to be attended to is, that the hopper be kept full of coal, and either wholly or in part small coal, to prevent, as much as possible, air getting in by that passage; it is also necessary at some times to use a shutter of thin plate-iron, to be applied to the mouth of the hopper to exclude the entrance of air by that passage.

(B) "These bars are, in fact, a grated door, kept in their position by a catch L, and which may be opened at pleasure for cleaning the fire out. In small furnaces an opening here is all that is necessary; the bars may be dispensed with.

(C) "Between the back end, *d*, of the bottom bars, and the breast brickwork *b*, is represented in the plate a section of a shutter, which is sometimes opened for the purpose of getting out the refuse of the fuel.

Furnace. Bunnell and Silver, Bedford-street, Covent-Garden, to see one of these furnaces at work, and we were not a little gratified in observing that the smallest appearance of smoke could not be perceived issuing from the top of the chimney. The advantages of such an improvement can hardly be better illustrated than by mentioning what had actually happened with this steam engine. The smoke, before the improved furnace was employed, incommoded the neighbourhood so much, that it was stopped as an intolerable nuisance. Now it is so far from disturbing any one, that, without being admitted to see the engine, it would be actually impossible to know when it is at work.

"These furnaces, we understand, have also been adopted by many intelligent manufacturers at Leeds and at Manchester. At the latter place, if we may credit newspaper reports, several manufacturers have had their works indicted as nuisances for not having adopted the improvement; the magistrates arguing, that, though the welfare of the place required that such inconveniences should be submitted to while no possible cure for them was known, the health and comfort of the inhabitants equally demand, now that the evil can be done away, that smoking furnaces should not be permitted in the place.

"We earnestly recommend to owners of steam engines, and also to those who are annoyed by them, to endeavour to bring this improvement into general use. Indeed, we entertain no doubt of its being universally adopted sooner or later; for it yields advantages not only in point of cleanliness, comfort, and health, but also in point of interest; all the smoke usually discharged at the top of the chimney, being in fact, so much good fuel, that only wanted the contact of fresh air to inflame it under the boiler. It is a fact well known, that the flame which is often seen issuing from the chimneys of founders, &c. has no existence except at the top of the chimney: while ascending the flue it is only dense smoke, consisting of the azote of the atmospheric air decomposed in passing through the fire, of hydrogen, coal tar, and carbonaceous matter, of such a high temperature, that it only wants oxygen to make it inflame spontaneously: this it obtains from the atmospheric air into which it ascends, and then presents such appearances as would make a hasty observer adopt the opinion that the flame had ascended, as flame, from the fuel in the furnace; which is by no means the case. A consideration of this simple fact will convince any person that it is not an inconsiderable proportion of the fuel that is thus wasted. Nor is this the only loss sustained; the quantity of heat required not merely to render such a portion of the fuel volatile, but to give to it a temperature able to produce the effect of which we have taken notice, is itself furnished at the expence of an extra and unnecessary quantity of fuel. The whole waste in many cases is, we are persuaded, not less than an eighth of the whole fuel employed."

Furnace for smelting iron.

One of the most important furnaces, particularly for this country, where, although great and essential improvements have been made by industry and ingenuity, the manufacture is yet in its infancy, is that for the smelting of iron.

We shall therefore enter more fully into the detail of the history, construction, and general principles of the operation of blast furnaces; and in tracing their progressive history, it may be observed, that in this country it has experienced a revolution, of which no analogous instance has occurred in other countries.

History.

In the early and barbarous periods of society, before the introduction of agriculture, the surface of a country is usually covered with extensive forests. From this circumstance wood, as being most accessible, abundant, and of easiest application, is usually employed by mankind for the purposes of fuel. In the progress of population and improvement, other advantages were derived from the general use of wood as fuel; and among these the improvement of the climate, and clearing land for the purposes of agriculture, were none of the least. The application of wood as fuel to different manufactories, had no doubt also an early origin; and in the manufacture of iron, if conducted on a scale of any extent, the demand for fuel of this kind must have been very great. If, then, during the gradual improvement and prosperity of this country, this manufacture, in place of remaining stationary, or declining, from diminished consumption, has increased in capital and extent, without some substitute for wood, the art would have been long before this time entirely lost, because it depended on a stock which must have rapidly declined, and even its very existence was often far from being compatible with the views and interest of landholders. Such were the circumstances in which Great Britain was placed, from the reign of Charles II. to the middle of the 18th century. During this period, being in a prosperous state, the manufactures and commerce of the country increased the demand for iron, while the supply of wood, one of the most necessary materials in its manufacture, was greatly diminished. It is true, indeed, that, previous to this period, pit-coal had been employed as a substitute; but the prejudice of some, and the selfish views of others, and especially the want of sufficient meehanical powers, obstructed the progress of this mode of manufacture. When, however, these difficulties were surmounted, and it was found that the change of fuel in the blast furnace was likely to prove beneficial, this manufacture acquired new vigour, and improvements succeeded each other in rapid succession. In a period of about 50 years, a complete revolution was effected, not only in relinquishing the mode of making iron with charcoal and in employing pit-coal in the blast furnace, but also in the immense increase of the manufacture.

and progress of in Britain.

At what period the manufacture of iron commenced in Britain, cannot be precisely ascertained. It has, however, been supposed, that the Phœnicians, who wrought the tin mines of Cornwall, may have introduced into the country men who were skilled in metallic ores, and were capable of estimating their value, by converting these mineral riches to such purposes as their own necessities, or the wants of the inhabitants, might require. It is probable also, that the invasion of England by the Danes, and their establishment in this country, added something to their former knowledge in the art of mining and manufacturing the ores of iron. In support of this conjecture, the large heaps of scoria found in many parts of England, and having a considerable thicknes of soil upon them, have been denominated from time immemorial, "Danes cinders;" and indeed so early as the year 1620, large oaks were found in a state of decay, upon the tops of some of those hills of of scoria. But although these may have been very ancient manufactures, it is the less probable that the production of these cinders is to be ascribed to the blast furnace; for at that remote period the manufacture was chiefly directed to the fabrication of small portions of malleable iron, in what were called foot-blasts and bloomeries. The art of casting or moulding in iron was either altogether unknown, or in so rude a state, that it could not be prosecuted with much prospect of advantage. Pig or cast iron, if it was at all produced, was then of the most refractory nature for being converted into malleable iron. It was not till a future period, when improvements had been made in machinery, and the advantages of a division of labour were known, that different furnaces were constructed; one for manufacturing pig iron, and another for converting it into malleable iron. To this the blast furnace seems to have owed its existence, and it is to be considered as an improvement of the advantages which are derived from a division of labour. The blast furnaces being exclusively appropriated to the making of pig iron, the attentive manufacturer would soon perceive that the products of the furnace were often different from each other. Repeated observation and experience would enable him to ascertain what was the cause of this difference. Observing that an additional quantity of fuel rendered the forged pig iron more fusible, this circumstance would suggest the practicability of casting it into shape. Hence probably arose the art of moulding, which afterwards, as well as the bar-iron forge, became an appendage to the blast furnace. After this new manufacture became familiar, the advantage of dividing the product of the blast furnace into gray melting iron, or into forged pigs, according to the demand, would be obvious.

[Nu]mber [of fur]naces [in E]ngland

In the year 1615, according to Dudley, who has stated the fact in his *Metallum Martis*, there were no less than 300 blast furnaces in England for smelting iron ore with charcoal, and each furnace was supplied with fuel upon an average of 40 weeks in the year. Taking the average produce of pig iron at each furnace of 15 tons per week, or 600 tons per annum, the total annual quantity will amount to 180,000 tons, which is a greater quantity than has ever been produced in Britain since that period. It is supposed that this quantity may be greatly exaggerated, but at the same time it is allowed that the iron manufactory was, at this early period, highly prosperous and productive. But in the progress of agriculture and the increase of population, it was necessary to clear the land for the purpose of cultivation. From this circumstance, as well as from the great consumption of wood for the navy, the supply of fuel was greatly diminished; so that the iron manufacture became consequently less productive.

[Pit-]coal used.

It is curious to remark that, although pit-coal was known long before this period, and was wrought at Newcastle previous to the year 1272, and great quantities of it were annually exported to Holland and the Low Countries, and was used in the smith's forge, and other manufactures which require a strong continued heat, yet in England the prejudice against its use in the manufacture of cast iron was so inveterate, that when it was first proposed and attempted, every obstacle which could be devised was thrown in its way. During the reign of James I. several patents were granted for the exclusive privilege of manufacturing iron with pit-coal. None of the adventurers, however, succeeded in their attempts till the year 1619, when Dudley made pig-iron in a blast furnace, but produced only three tons in the week. At this time the price of iron had risen, in consequence of many of the iron-works having stopped for want of wood as fuel. To those manufacturers, therefore, who could still be furnished with a supply of wood, the manufacture was highly profitable, so that they opposed any new attempt by which the price of iron was likely to be diminished.

After this period, the progress of the iron manufacture was greatly interrupted from other causes. Amidst the distraction occasioned by the civil wars which raged in England, little improvement was to be expected. It appears, however, that patents were granted during the Commonwealth, for the exclusive privilege of manufacturing iron in the new way; and in one of these, it was believed at the time, that the Protector himself had a share. All these experienced the fate of the former, and no manufacture of any extent was successfully established. In the year 1663, Dudley in his application for his last patent, stated that he could produce at one time seven tons of pig iron in the week with a furnace of an improved construction, 27 feet square, and with bellows which one man, without much fatigue, could work for an hour.

Thus, as the demand for wood for the purposes of fuel in this manufacture increased, and the growth of timber was greatly diminished, the manufacturer was forced by necessity to have recourse to the use of pit-coal; and when various valuable improvements had been made on machinery, and particularly when the beneficial effects of the steam engine had been ascertained, the iron manufacturer saw himself in possession of a command of power in the management of his materials, of which he had formerly no conception. The small furnace supplied with air from bellows constructed of leather, which was moved by means of oxen, horses, or men, went into disuse, when larger furnaces were introduced, with an increase of the column of air, for the purpose of exciting combustion. But at this period, when the manufacture derived new vigour from the introduction of the steam engine, and the general improvement in machinery, it seemed, from the operation of other causes, and particularly from the deficiency of fuel, to decline rapidly. The demand for iron in the manufactured state, and particularly for bar iron, had increased, while the quantity produced gradually diminished. Recourse was now had to foreign markets for a supply, and the importation of Russian and Swedish iron then commenced. Of the 300 blast furnaces spoken of by Dudley, 59 only existed; and estimating their annual produce at about 295 tons to each furnace, the total amount did not much exceed 17,000 tons.

Such was the state of the manufacture of iron in England and Wales, before the introduction of pit-coal; and thus it appears, that in a period of from 100 to 130 years, it had suffered a diminution of more than 50,000 tons annually. It proved of singular benefit to this manufacture, that the steam engine, which had then become a powerful machine, was introduced, for the purpose of raising and compressing the air, and could be employed in those places where materials were abundant, but where there was a deficiency of water for moving the machinery. Besides, experience now taught the

the manufacture, that the produce of his furnace could be increased by enlarging the diameter of the steam cylinder, for rendering the vacuum under the piston more perfect; and it was soon found that, by increasing these effects, such a quantity of pig iron could be produced from the coak of pit-coal, as would be attended with a suitable profit. It is scarcely to be wondered at, that this circumstance should have long remained a secret; for a small quantity of air only being necessary to ignite the charcoal furnace, whether it arose from the peculiar inflammability of the fuel, or the small capacity of the furnace, it was always under the eye of the manufacturer, and he would more frequently experience the inconveniences of overblowing than underblowing the furnace. It seems too extremely probable, that pit-coal, being considered in every respeet inferior to charcoal, the manufacturer would proceed with great caution in enlarging the column of air, or increasing its density; and thus the advantages to be derived from its use would be in a great measure lost. When, however, experience had taught them a different lesson, the limits to the quantity of air that might be directed to a coak blast furnace, before any injurious effects arose, were not very observable. It was found, indeed, that the density of air diminished the quantity of the produce, and the same law seemed to hold with regard to pit-coal as well as to wood,—that the softer qualities might be overblown, while the strata of a denser and more compact consistence remained undiminished before a heavier blast.

Comes into general use.

Between the years 1750 and 1760 the coak of pit-coal was pretty generally substituted for charcoal, in the blast furnace. The iron manufacture assumed new vigour, and in a period of 30 years it experienced in England and Wales a very remarkable progress. From the general and increasing use of pit-coal, it is probable that many of the charcoal works were sooner relinquished than they would otherwise have been. The history of the celebrated foundery of Carron in Scotland, affords us a curious instance of the progress of the use of pit-coal in this mannfacture. These extensive operations commenced about the year 1760. The blowing, as was the practice at the time, was performed by means of large bellows, moved by a water wheel. But as there was a scanty supply of air, and as this was deficient in density, the weekly produce of the furnace rarely exceeded 10 or 12 tons, and often in summer this quantity was considerably diminished. With a view to improve the operation, immense quantities of wood charcoal were prepared, and it was found that the process of smelting succeeded much better with this kind of fuel than with the mineral coal which was dug out in the neighbourhood. But in the improvement of machinery, more effectual means were discovered to procure a blast of sufficient force and density for the ignition of pit-coal, wheels of greater force were constructed; the use of the bellows was relinquished, and in their place large iron cylinders, so contrived as to blow both up and down, were introduced. Thus, a larger column of air, of three or four times the former density, was obtained, and the beneficial effects arising from the improvements were soon perceived; for the same furnace which formerly produced 10 or 12 tons in the week, sometimes yielded 40 tons in the same time; and on an annual average, not less than 15,000 tons of metal.

About the end of the reign of Queen Elizabeth, we are informed by Dudley, that blast furnaces had been constructed on so large a scale, and with such a power of machinery, as to yield a daily produce of more than two tons of charcoal iron; but it is probable that so large a produce could only be obtained in situations where there was a copions supply of water, and where the water wheels and bellows employed were of large size. In the more ordinary modes of conducting this process, furnaces of a much smaller size were employed, and these received the supply of air from hand bellows which were moved by men, and sometimes by cattle. From the superiority of the manufacture of iron guns, mortars, &c. England possessed at this time a considerable export trade; but as pit-coal had not yet been applied to any departments in the manufacture of iron, it seems probable that these articles were cast from the large blast furnaces, because the flame of wood, comparing it with that of pit-coal, possessing but feeble effects, would render the application of the reverberating furnace (if it was then known), of no use in the casting of guns and mortars. The want of pit-coal in every department of the foundery, greatly retarded the perfection to which the art of moulding might have arrived, and even obstructed its improvement. The backward state in which the art of casting and moulding long remained in this country, shewed that the want of this material of the smelting fuel in the blast furnace was long severely felt; and owing to this, other nations, who in many other respects enjoyed fewer advantages, made more rapid progress in the improvement of this manufacture. Before this period, it is not improbable that the use of pit-coal might have been suggested to the manufacturer, and that this material, employed as a fuel, might have been considered as an auxiliary, or as a substitute in various departments of the process. The inflammability of this substance, and its tendency to be converted into a cinder, as well as the general decay of wood, would afford sufficient ground for what might be considered by many as a useful speculation. The benefits of this manufacture as it then stood, had been carefully investigated, and fully appreciated by those who were interested in it. The supply of wood only seemed to limit its extent, but for want of a sufficient supply of materials, the establishment of new works became impracticable, those already engaged in the business were anxious to preserve the supply they enjoyed, however limited, rather than encourage any innovation or change in the process, which, by the substitution of pit-coal for charcoal from wood, would probably give to new adventurers and speculators a superiority of the market. Besides, many of the furnaces which were then going, were at a great distance from pit-coal, so that the general use of this substance, and the advantages to be derived from it, would be highly injurious to their interests.

Such was the state of this manufacture when the use of pit-coal in this process was discovered, or when it was proposed to employ it for this purpose. With this view, James I. in the year 1612, granted a patent to Simon Sturtevant, for the exclusive manufacture of iron with pit-coal, for the period of 31 years. In obtaining this privilege,

privilege, the patentee obliged himself to publish a full account of his discoveries, and this appeared in a work in quarto, under the title of "Metallica." It appears, however, that Sturtevant had not succeeded in his schemes; for in the following year he gave up his privilege, but it is not known to what causes the failure is to be ascribed.

Another adventurer.

After Sturtevant, a John Ravenson, embarked in the same hazardous undertaking; and although he procured a patent without much trouble, he had soon to encounter difficulties in the way of ultimate success, analogous to those which had prevailed over the perseverance of Sturtevant, and induced him to relinquish the farther prosecution of his schemes. He obtained his patent on conditions similar to those on which his predecessor procured it, in consequence of which he published his "Metallica" in 1613. All his successors were, like him, obliged to resign their patents from the want of adequate success.

Dudley obtains patent.

Dudley procured his patent in the year 1619, and notwithstanding he affirmed that he manufactured not more than three tons per week, he found it a lucrative undertaking. This discovery he brought to perfection at the works of his father in Worcestershire; but by the influence of those who wished to share in the emoluments arising from the manufacture of iron with pit-coal, his patent was limited to 14 instead of 31 years. He informs us himself, that, during the greater part of this period, he was enabled to sell pig and bar iron much cheaper than any of his competitors; but as his remarkable success drew their envy upon him, his devoted works were at length destroyed by a lawless mob, urged on, it is supposed, to perpetrate so atrocious a deed by his rivals in business. In this unmerited treatment of the sanguine but unfortunate Dudley, the coke pig process unquestionably experienced an irreparable loss. He had so many rivals to contend with, by virtue of the original ground he occupied as a manufacturer, and his attachment to the cause of royalty was so sincere, that his improvements were effectually prevented from arriving at lasting or general utility. Could he have procured a new patent after the restoration, there is little doubt but he would have again entered with avidity on the laborious paths of discovery. In petitioning for the recovery of his ancient privileges, we find him declaring that instead of three, he was enabled to manufacture seven tons per week of coke pig iron, in consequence of a large furnace, and an improved bellows.

Attempts to evade it.

To stand clear as much as possible of the method of operation which Dudley had discovered, one Captain Buck, Major Wildman, and some others, constructed large air-furnaces in the forest of Dean, into which they put clay pots, for containing the requisite preparations of ore and charcoal. Pit-coal was employed for the purpose of heating the furnaces; and it is highly probable that these new adventurers were sanguine enough to believe that, by tapping the pots below, the separated metal would flow out. This strange method of assaying was soon found impracticable; for the heat was not of sufficient intensity to produce an entire separation; the pots gave way, and the prosecution of this ridiculous scheme was speedily relinquished.

The manufacture of iron received no farther improvements for about a century after this period. It was found to be practicable; but how to procure such a quantity as to produce a lucrative return, was not to be derived from the mere knowledge of the particular proportions of the raw materials. Had machinery reached that degree of perfection in the time of the ill-fated Dudley which it has since done, we have good reason to believe that the rapid progress of the pig iron manufacture would have dated its origin from the æra of that enterprising genius.

Produce of furnaces in Britain.

We shall conclude this historical account of the iron manufacture, with a view of the progressive quantity produced at the different furnaces in Great Britain at different periods.

	Tons.
In 1620, the 300 blast furnaces mentioned by Dudley, which existed in England and Wales, produced each at an average -	250
At a later period, but previous to the use of pit-coal, 59 furnaces produced each on an average	294
In 1788, 24 charcoal furnaces, which were then going in England, produced each on an average - - - -	545
In 1788, 53 blast furnaces, in which coak from pit-coal was used, yielded each on an average, nearly - - - -	907
In 1788, eight furnaces in Scotland produced on an average, each - -	875
In 1796, there were in England and Wales, 104 furnaces, from each of which was obtained on an average - - -	1048
In 1796, 17 furnaces in Scotland produced each on an average - - -	946

But from the above statement we are not enabled to draw an accurate conclusion of the degree of improvement which has been introduced in blowing machinery; for among the furnaces mentioned in 1796, were included a number of charcoal blasts, which yielded only a small produce. But the average produce of iron manufactured at pit-coal blast furnaces, at no less an amount than

	Tons.
At melting furnaces - - - -	1200
At forge pig works - - - -	2000

Prices at different periods.

To what we have now said, we shall only give a view of the prices of the produce of this manufacture, and the channels of consumption for this immense quantity of materials.

	Per Ton.		
Charcoal pig iron sold in 1620 for - -	L.6	0	0
Ditto for melting in 1788 - -	8	0	0
Ditto in 1798 - - - -	9	10	0
Coak pig iron in the time of Dudley -	4	0	0
Ditto in 1788 - - - -	5	10	0
Ditto in 1798 - - - - -	7	10	0
Melting iron in 1802 - - - -	8	10	0

The produce of pig iron in England and Wales, and in Scotland, from 168 furnaces, has been calculated at the immense quantity of 172,000 tons. It will be impossible to say with absolute precision what are the channels into which this immense quantity of raw materials passes for consumption; but the following views will enable the reader to account for part of it.

Consumption of pig iron.

	Tons.
Annual consumption in the erection of new furnaces, forges, &c. - - - -	5000

Furnace.

	Tons.
Annual consumption at forges in Britain, for the manufacture of bar iron	70,000
Purchased by government in the state of cannons, mortars, &c. on an average of three years, including the waste in melting, &c. with what is employed in the navy as ballast	14,899
Ditto by the India Company	5,700
Ditto for merchantmen	11,000
Ballast for India and merchantmen	5,000

Principles of the blast furnace.

Let us now consider the construction and general principles of the blast furnace. The term *blast* is employed at iron founderies, to signify the column of air which is forced into the furnace for the purpose of promoting combustion. The velocity of this blast is produced by the blowing machine impelling the contents of the air-pump through one or two small apertures, and in this way a column of air of various density is produced.

Here we propose to avail ourselves of what has been done by Mr Mushet, formerly of the Calder iron works near Glasgow, a manufacturer himself, who with much philosophical discrimination joins a great deal of excellent practical observation. The many valuable hints which he has suggested, will, we trust, not only be acceptable, but prove highly beneficial in directing and assisting the views and operations of those concerned in this important manufacture.

To have a clear view of his reasonings and observations on the nature and principles of the blast furnace, we shall first give his description of the building and apparatus, and then detail what he has said concerning its management and mode of operation.

Plate CCXXV. fig. 3. Description of a furnace.

Fig. 3. represents a blast furnace with part of the blowing machine. A, the regulating cylinder, eight feet diameter and eight feet high. B, the floating piston, loaded with weights proportionate to the power of the machine. C, the valve, by which the air is passed from the pumping cylinder into the regulator: its length 26 inches, and breadth 11 inches. D, the aperture by which the blast is forced into the furnace. Diameter of this range of pipes 18 inches. The wider these pipes can with conveniency be used, the less is the friction, and the more powerful are the effects of the blast. E, the blowing or pumping cylinder, six feet diameter, nine feet high: travel of the piston in this cylinder from five to seven feet per stroke. F, the blowing piston, and a view of one of the valves, of which there are sometimes two, and sometimes four, distributed over the surface of the piston. The area of each is proportioned to the number of valves: commonly they are 12+46 inches. G, a pile of solid stone building, on which the regulating cylinder rests, and to which the flanch and tilts of the blowing cylinder are attached. H, the safety-valve, or cock; by the simple turning of which the blast may be admitted to, or shut off from the furnace, and passed off to a collateral tube on the opposite side. I, the tuyere, by which the blast enters the furnace. The end of the tapered pipe, which approaches the tuyere, receives small pipes of various diameters, from two to three inches, called *nose pipes*. These are applied at pleasure, and as the strength and velocity of the blast may require. K, the bottom of the hearth, two feet square. L, the top of the hearth two feet six inches square. KL, the height of the hearth six feet six inches. L is also the bottom of the boshes, which here terminate of the same size as the top of the hearth; only the former are round, and the latter square. M, the top of the boshes, 12 feet diameter and eight feet of perpendicular height. N, the top of the furnace, at which the materials are charged; commonly three feet diameter. MN, the internal cavity of the furnace from the top of the boshes upwards, 30 feet high. NK, total height of the internal parts of the furnace, $44\frac{1}{2}$ feet. OO, the lining. This is done in the nicest manner with fire bricks made on purpose, 13 inches long and three inches thick. PP, a vacancy which is left all around the outside of the first lining, three inches broad, and which is beat full of coke-dust. This space is allowed for any expansion which might take place in consequence of the swelling of the materials by heat when descending to the bottom of the furnace. QQ, the second lining, similar to the first. R, a cast-iron lintel, on which the bottom of the arch is supported. RS, the rise of the arch. ST, height of the arch; on the outside 14 feet, and 18 feet wide. VV, the extremes of the hearth, ten feet square. This and the bosh-stones are always made from a coarse gritted freestone, whose fracture presents large rounded grains of quartz, connected by means of a cement less pure.

Fig. 4.

Fig. 4. represents the foundation of the furnace, and a full view of the manner in which the false bottom is constructed.

AA, the bottom stones of the hearth. B, stratum of bedding sand. CC, passages by which the vapours, which may be generated from the damps, are passed off. DD, pillars of brick. The letters in the horizontal view, of the same figure, correspond to similar letters in the dotted elevation.

Fig. 5.

Fig. 5. AA, horizontal section of the diameter of the boshes, the lining and vacancy for stuffing at M. C, view of the top of the hearth at L.

Fig. 6.

Fig. 6. vertical side-section of the hearth and boshes; shewing the tymp and dam-stones, and the tymp and dam-plates. *a*, the tymp-stone. *b*, the tymp-plate, which is wedged firmly to the stone, to keep it firm in case of splitting by the great heat. *c*, dam-stone, which occupies the whole breadth of the bottom of the hearth, excepting about six inches, which, when the furnace is at work, is filled every cast with strong sand. This stone is surmounted by an iron plate of considerable thickness, and of a peculiar shape *d*, and from this called the dam-plate. The top of the dam-stone and plate is two, three, or four inches under the level of the tuyere hole. The space betwixt the bottom of the tymp and the dotted line is also rammed full of strong sand, and sometimes fire-clay. This is called the tymp-stopping, and prevents any part of the blast from being unnecessarily expended.

The square of the base of this blast-furnace is 38 feet; the extreme height from the false bottom to the top of the crater is 55 feet.

Mode of operation.

Having given the above description of the construction of the furnace, Mr Mushet next proceeds to take a view of its mode of operation and management. "The operations (he observes) I am about to describe have never as yet received any explanation consonant to true philosophy or chemical facts; yet there are few which present

Furnace. present a more beautiful chain of affinities, decomposition, and recombination, than the manufacture of iron in all its various stages. An extensive foundery is a laboratory fraught with phenomena of the most interesting nature in chemistry and natural philosophy: are we not then justly surprised to find that prejudice still reigns there; and that the curious manipulations of these regions are still shrouded with error and misconception; as if their dingy structure forbade the entrance of genius, or consigned her laborious unlettered sons to an endless stretch of mental obscurity?"

Having described the furnace, he continues, "I shall proceed to detail the train of preparation necessary before the furnace is brought to produce good melting iron.

Putting in preparation.

"The furnace being finished, the bottom and sides of it, for two feet up the square funnel, receive a lining of common bricks upon edge, to prevent the stones from shivering or mouldering when the fire comes in contact with it. On the front of the furnace is erected a temporary fire-place, about four feet long, into the bottom of which are laid corresponding bars. The side-walls are made so high as to reach the under surface of the tymp-stone; excepting a small space, which afterwards receives an iron plate of an inch and a half thick, by way of a cover: This also preserves the tymp-stone from any injury it might sustain by being in contact with the flame. A fire is now kindled upon the bars, and is fed occasionally with small coals. As the whole cavity of the furnace serves as a chimney for this fire, the draught in consequence is violent, and the body of heat carried up is very considerable. In the course of three weeks the furnace will thus become entirely free from damp, and fit for the reception of the materials: when this is judged proper the fire-place is removed, but the interior bricks are allowed to remain till the operation of blowing commences. Some loose fuel is then thrown upon the bottom of the furnace, and a few baskets of cokes are introduced; these are allowed to become thoroughly ignited before more are added. In this manner the furnace is gradually filled; sometimes entirely full, and at other times 5-8ths or 3-4ths full. The number of baskets full depend entirely upon the size of the furnace: that in the plate will contain 900 baskets. If the coal is splint, the weight of each basket-full will be nearly 110lb. $\times$ 900=99,000lb. cokes. As this quality of cokes is made with a loss of nearly 50 per cent. the original weight in raw coals will be equal to 198,000lb. When we reflect that this vast body of ignited matter is replaced every third day, when the furnace is properly at work, a notion may be formed of the immense quantity of materials requisite, as also the consequent industry exerted to supply one or more furnaces for the space of one year.

"When the furnace is sufficiently heated throughout, specific quantities of cokes, iron-stone, and blast-furnace cinders are added: these are called charges. The cokes are commonly filled in baskets, which, at all the various iron-works, are nearly of a size. The weight of a basket, however, depends entirely upon the nature and quality of the coal, being from 70 to 112lb. each (D). The iron-stone is filled into boxes, which, when moderately heaped, contain 56lb. of torrefied iron-stone; they often exceed this when the stone has been severely roasted. The first charges which a furnace receives, contain but a small proportion of iron-stone to the weight of cokes: this is afterwards increased to a full burden, which is commonly four baskets cokes, 320lb.; two boxes iron-stone, 112lb.; one box of blast-furnace cinders, 60 or 70lb. (E). At new works, where these cinders cannot be obtained, a similar quantity of limestone is used.

Furnace. Charging it.

"The descent of the charge, or burden, is facilitated by opening the furnace below two or three times a-day, throwing out the cold cinders, and admitting, for an hour at a time, a body of fresh air. This operation is repeated till the approach of the iron-stone and cinder, which is always announced by a partial union, and the dropping of lava through the iron bars, introduced to support the incumbent materials while those on the bottom are carried away. The filling above is regularly continued, and when the furnace at the top has acquired a considerable degree of heat, it is then judged time to introduce the blast; the preparations necessary for which are the following:—

Time to apply the blast.

"The dam-stone is laid in its place firmly imbedded in fire-clay; the dam-plate is again imbedded on this with the same cement, and is subject to the same inclination. On the top of this plate is a slight depression, of a curved form, towards that side farthest distant from the blast, for the purpose of concentrating the scoria, and allowing it to flow off in a connected stream, as it tends to surmount the level of the dam. From this notch to the level of the floor a declivity of brick-work is erected, down which the scoria of the furnace flows in large quantities. The opening betwixt the dam and side-walls of the furnace, called the *fauld*, is then built up with sand, the loose bricks are removed, and the furnace bottom is covered with powdered-lime or charcoal-dust. The ignited cokes are now allowed to fall down, and are brought forward with iron bars nearly to a level with the dam. The space between the surface of the cokes and the bottom of the tymp-plate is next rammed hard with strong binding sand; and these cokes, which are exposed on the outside, are covered with coke-dust. These precautions being taken, the tuyere-hole is then opened and lined with a soft mixture of fire clay and loam: the blast is commonly introduced into the furnace at first with a small discharging-pipe, which is afterwards increased as occasion may require. In two hours

(D) "This same variety in the coal renders it almost impossible, under one description, to give a just idea of the proportions used at various blast furnaces: to avoid being too diffuse, I shall confine my description connected with a coal of a medium quality, or a mixture of splint and free-coal, a basket of which will weigh from 78lb. to 84lb.

(E) "A preference at first is always given to blast-furnace cinders in place of lime; being already vitrified, they are of much easier fusion, and tend to preserve the surface of the hearth by glazing it over with a black vitrid crust.

Furnace. hours after blowing, a considerable quantity of lava will be accumulated; iron bars are then introduced, and perforations made in the compressed matter at the bottom of the furnace; the lava is admitted to all parts of the hearth, and soon thoroughly heats and glazes the surfaces of the fire-stone. Shortly after this it rises to a level with the notch in the dam-plate, and by its own accumulation, together with the forcible action of the blast, it flows over. Its colour is at first black; its fracture dense and very ponderous; the form it assumes in running off is flat and branched, sometimes in long streams, and at other times less extensive. If the preparation has been well conducted, the colour of the cinder will soon change to white; and the metal, which in the state of an oxyde formerly coloured it, will be left in a disengaged state in the furnace. When the metal has risen nearly to a level with the dam, it is then let out by cutting away the hardened loam of the fauld, and conveyed by a channel, made in sand, to its proper destination; the principal channel, or runner, is called the *sow*, the lateral moulds are called the *pigs*.

Fused metal let out.

"In six days after the commencement of blowing, the furnace ought to have *wrought herself clear*, and have acquired capacity sufficient to contain from 5000 to 7000 weight of iron. The quality ought also to be richly carbonated, so as to be of value and estimation in the pig-market. At this period, with a quality of coal as formerly mentioned, the charge will have increased to the following proportions:—Five baskets cokes, 400lb.; six boxes iron-stone, 336lb.; one box limestone, 100lb.

"An analysis of the smelting operation, and the tendency which the individual agents have to produce change in the quality and quantity of the iron, come next under consideration. Let us, however, first notice the characteristic features exhibited by the different kinds of iron while in fusion, whereby the quality of the metal may be justly defined.

Characters of the produce.

"When fine (N° 1.) or super-carbonated crude iron is run from the furnace, the stream of metal, as it issues from the fauld, throws off an infinite number of brilliant sparkles of carbone. The surface is covered with a fluid pellicle of carburet of iron, which, as it flows, rears itself up in the most delicate folds: at first the fluid metal appears like a dense, ponderous stream, but, as the collateral moulds become filled, it exhibits a general rapid motion from the surface of the pigs to the centre of many points; millions of the finest undulations move upon each mould, displaying the greatest nicety and rapidity of movement, conjoined with an uncommonly beautiful variegation of colour, which language is inadequate justly to describe. Such metal, in quantity, will remain fluid for 20 minutes after it is run from the furnace, and when cold will have its surface covered with the beautiful carburet of iron, already mentioned, of an uncommonly rich and brilliant appearance. When the surface of the vessel is not carbureted, it is smooth like forged iron, and always convex. In this state iron is too rich for melting without the addition of coarse metal, and is unfit to be used in a cupola furnace for making fine castings, where thinness and a good skin are requisite.

"N° 4. or oxygenated crude iron, when issuing from the blast furnace, throws off from all parts of the fluid surface a vast number of metallic spars: they arise from a different cause than that exerted in the former instance. The extreme privation of carbone renders the metal subject to the combination of oxygen so soon as it comes into contact with atmospheric air. This truth is evidently manifested by the ejection of small spherules of iron from all parts of the surface; the deflagration does not, however, take place till the globule has been thrown two or three feet up in the air; it then inflames and separates with a slight hissing explosion, into a great many minute particles of a brilliant fire. When these are collected they prove to be a true oxyde of iron, but so much saturated with oxygen, as to possess no magnetic obedience. The surface of oxygenated iron, when running, is covered with waving flakes of an obscure smoky flame, accompanied with a hissing noise; forming a wonderful contrast with the fine rich covering of plumbago in the other state of the metal, occasionally parting and exhibiting the iron in a state of the greatest apparent purity, agitated in numberless minute fibres, from the abundance of the carbone united with the metal.

"When iron thus highly oxygenated comes to rest, small specks of oxyde begin to appear floating upon the surface: these increase in size; and when the metal has become solid, the upper surface is found entirely covered with a scale of blue oxyde of various thicknesses, dependent upon the stage of oxygenation or extreme privation of carbone. This oxide, in common, contains about 15 per cent. of oxygen, and is very obedient to the magnet. In place of a dark blue smooth surface, convex and richly carbonated, the metal will exhibit a deep, rough, concave face, which, when the oxyde is removed, presents a great number of deep pits. This iron in fusion stands less convex than carbonated iron, merely because it is less susceptible of a state of extreme division; and indeed it seems a principle in all metallic fluids, that they are convex in proportion to the quantity of carbone with which they are saturated. This iron flows dead and ponderous, and rarely parts in shades but at the distance of some inches from each other.

"This is a slight sketch of the appearance of the two extreme qualities of crude or pig iron, when in a state of fusion. According to the division formerly made, there still remain two intermediate stages of quality to be described: these are, carbonated and carbo-oxygenated iron; that is N° 2. and 3. of the manufacturers. Carbonated iron exhibits, like N° 1. a beautiful appearance in the runner and pig. The breakings of the fluid, in general, are less fine; the agitation less delicate; though the division of the fluid is equal, if not beyond that of the other. When the internal ebullition of the metal is greatest, the undulating shades are smallest and most numerous: sometimes they assume the shape of small segments; sometimes fibrated groups; and at other times minute circles, of a mellower colour than the ground of the fluid. The surface of the metal, exposed to the external air, when cooling, is generally slightly convex, and full of punctures: these, in iron of a weaker and fusible nature, are commonly small in the diameter, and of no great depth. In strong metal the punctures are much wider and deeper. This criterion, however, is not infallible, when pig-iron of different works, is taken collectively. At each individual work, however, that iron will be strongest whose honeycombs are largest and deepest.

"Carbo-

"Carbo-oxygenated, or N° 3. pig-iron, runs smoothly, without any great degree of ebullition or disengagement of metallic sparks. The partings upon its surface are longer, and at greater distances from each other than in the former varieties: the shape they assume is either elliptical, circular, or curved. In cooling, this metal acquires a considerable portion of oxyde; the surface is neither markedly convex nor concave; the punctures are less, and frequently vanish altogether. Their absence, however, is no token of a smooth face succeeding: in qualities of crude iron oxygenated beyond this, I have already mentioned that a concave surface is the consequence of the extreme absence of carbone; and that, in proportion as this principle is absent, the surface of the iron acquires roughness and asperity.

"It may perhaps be proper here to mention, once for all, that although, for convenience, the manufacturer has, from a just estimation of the value of the metal in a subsequent manufacture, affixed certain numbers for determinate qualities of iron, yet it is difficult to say at what degree of saturation of carbone each respective term commences: suffice it then to say, that the two alternative principles, oxygen and carbone, form two distinct classes, that in which oxygen predominates, and that in which carbone predominates; the latter comprehends N° 1. and 2. of the manufacturers, the former includes oxygenated, white and mottled; and the equalization of these mixtures form, as has already been noticed, the variety of carbo-oxygenated crude iron.

"I shall now observe some things relative to the various faces which crude iron assumes. N° 1. and 2. with their intermediate qualities, possess surfaces more or less convex, and frequently with thin blisters: this we attribute to the presence of carbone, which being plentifully interspersed betwixt and throughout the particles of the metal, the tendency which the iron has to shrink in cooling is entirely done away; it tends to distend the aggregate of the mass, and to give a round face, by gradually elevating the central parts of the surface, which are always last to lose their fluidity.

"Again, that quality of iron known by the name of N° 3. or carbo-oxygenated, is most commonly found with a flat surface. If we still farther trace the appearance of the surface of pig-iron, when run from the furnace, we shall find N° 4. either with a white or mottled fracture, possessed of concave faces rough and deeply pitted. Beyond this it may be imagined that every degree of further oxygenation would be productive of a surface deeper in the curve, and rougher, with additional asperities. The contrary is the case: when crude iron is so far debased as to be run from the furnace in clotted lumps highly oxygenated, the surface of the pigs is found to be more convex than that of N° 1. iron; but then the fracture of such metal presents an impure mass covered on both faces with a mixture of oxydated iron, of a blueish colour, nearly metallic. In short, this quality of iron is incapable of receiving such a degree of fluidity as to enable us to judge whether the convexity of its surface is peculiar to its state, or is owing to its want of division as a fluid, whereby the gradual consolidation of the metal is prevented.

"These features sufficiently distinguish betwixt the various qualities of crude iron after they are obtained from the blast furnace: there are, however, criterions not less infallible, whereby we can prejudge the quality of the metal many hours before it is run from the furnace. These are the colour and form of the scoria, the colour of the vitrid crust upon the working bars, and the quantity of carburet which is attached to it. The variety of colour and form in the cinder almost universally indicate the quality of the metal on the hearth. Hence, from a long course of experience, have arisen the following denominations: "Cinder of sulphury iron;" "Cinder of N° 1. N° 2. and N° 3.;" and "Cinder of ballast iron." Although at different works, from local circumstances, the same kind of scoria may not indicate precisely the same quality of iron, yet the difference is so small that the following description of the various cinders may convey a very just idea of their general appearance.

Determined from the colour and form of the scoria.

"When the scoria is of a whitish colour and short form, branching from the notch of the dam, and emitting from its stream beautiful sparks of ignited carbone, resembling those ejected from a crucible of cast steel in fusion, exposed to external air, or to the combustion of fine steel filings in a white flame; if, when issuing from the orifice of the furnace, it is of the purest white colour, possessing no tenacity, but in a state of the greatest fluid division, and, when cold, resembles a mass of heavy torrefied spar, void of the smallest vitrid appearance, hard and durable, it is then certain that the furnace contains *sulphury iron*, i. e. super-carbonated iron. At blast furnaces, where a great quantity of air is thrown in per minute, super-carbonated crude iron will be obtained with a cinder of a longer form, with a rough flint fracture towards the outside of the column.

"That cinder which indicates the presence of carbonated iron in the hearth of the furnace, forms itself into circular compact streams, which become consolidated and inserted into each other; these are in length from three to nine feet. Their colour when the iron approaches the first quality, is a beautiful variegation of white and blue enamel, forming a wild profusion of the elements of every known figure; the blues are lighter or darker according to the quantity of the metal and the action of the external air while cooling. When the quality of the pig-iron is sparingly carbonated, the blue colour is less vivid, less delicate; and the external surface rougher, and more sullied with a mixture of colour. The same scoria, when fused in vessels which are allowed to cool gradually, parts with all its variety and shade, and becomes of a yellowish colour, sometimes nearly white when the quantity of incorporated metals has been small.

"The cinder which is emitted from the blast furnace when carbo-oxygenated (or N° 3.) iron is produced, assumes a long zig zag form. The stream is slightly convex in the middle; broad, flat, and obliquely furrowed towards the edges. The end of the stream frequently rears itself into narrow tapered cones, to the height of six or eight inches: these are generally hollow in the centre, and are easily demolished, owing to their excessive brittleness. The colour of this lava is very various; for the most it is pale yellow, mixed with green. Its tenacity is so great, that if, while fluid, a small iron hook is inserted into it at a certain degree of heat, and then drawn from it with a quick but steady motion, 20 to 30 yards of fine glass thread may be formed with ease. If the colours are vivid and variegated, the thread will possess, upon a minute scale, all the

Furnace. the various tints of colouring which is found in the columnar mass. When by accident a quantity of this lava runs back upon the discharging-pipe, it is upon the return of the blast impelled with such velocity as to be blown into minute delicate fibres, smaller than the most ductile wire; at first they float upon the air like wool, and when at rest very much resemble that substance.

"The presence of oxygenated crude iron (N° 4.) on the furnace hearth, is indicated by the lava resolving itself into long streams, sometimes branched, sometimes columnar, extending from the notch to the lowest part of the declivity; here it commonly forms large, flat, hollow cakes, or inclines to form conical figures: these are, however, seldom perfect; for the quantity of fluid lava, conveyed through the centre of the column, accumulates faster than the internal sides of the cone are consolidated; and thus, when the structure is only half finished, the small crater vomits forth its superabundant lava, and is demolished. The current of such lava falls heavily from the dam as if surcharged with metal, and emits dark red sparks resembling the agitation of straw embers. Its colour is still more varied than the former descriptions of scoriæ, and is found changing its hues through a great variety of greens shaded with browns. Another variety of scoria, which indicates the same quality of iron, assumes a similar form; but has a black ground colour mixed with browns, or is entirely black. When the latter colour prevails, the texture of the cinder becomes porous; the quantity of iron left is now very considerable, and such as will be easily extracted in the assay-furnace with proper fluxes. In cases of total derangement in the furnace, the scoria will still retain this black colour, although the quantity of metal may amount to 25 per cent.; the fracture, however, becomes dense, and its specific gravity increases in proportion to the quantity of metal it holds incorporated.

"The next source of information, as to the quality of the iron in the furnace, is to be got from the colour of the scoria upon the working bars, which are from time to time inserted to keep the furnace free from lumps, and to bring forward the scoria. When supercarbonated crude iron is in the hearth, the vitrid crust upon the bars will be of a black colour and smooth surface, fully covered with large and brilliant plates of plumbago.

"As the quality of the metal approaches to N° 2. (carbonated), the carburet upon the scoria decreases both in point of quantity and size.

"When carbo-oxygenated iron (N° 3.) is in the furnace, the working bars are always coated with a lighter coloured scoria than when the former varieties exist; a speck of plumbago is now only found here and there, and that of the smallest size. When the quality of the metal is oxygenated (N° 4.), not only have the plates of carburet disappeared, but also the coally colour on the external surface of the scoria; what now attaches to the bars, is nearly of the same nature and colour as the lava emitted at the notch of the dam.

"These criterions are infallible; for, as the fusibility or carbonation of the metal is promoted in a direct ratio to the comparative quantity of the coally principle in the furnace, so in the same proportion will the vitrid crust encircling the working bars exhibit the presence of that principle in the furnace.

"In the smelting operation a just proportion and association of materials and mechanical construction ought to be blended in order to produce the best possible effects. Under the former are comprehended the cokes, iron-stone, limestone, and blast; by the latter is understood the furnace, the power of the blowing-machine, or the compression and velocity under which the air is discharged into the furnace, and the genius or mechanical skill of the workmen. According to this division I shall endeavour to point out the very various effects which disproportion in any case produces, and *vice versa*.

"In the preceding observations the coal and iron stone have been traced through their various stages of preparation, and that stage pointed out in which they were most suitable for the profitable manufacture of the metal. It will be necessary to carry along with us this fact, that in the exact proportion which the quantity of carbone bears to the quantity of metal in the ore, and its mixtures, so will be the fusibility, and of course the value of the pig-iron obtained. The importance of this truth will still farther appear when we consider the very various qualities of pit-coal, the different proportions of carbone which they contain, and the various properties attached to every species of this useful combustible.

"Among the many strata of coal which I have distilled, some I have found to contain 70 parts in the 100. This large proportion is peculiar to the clod-coal, used at some of the iron works in England, and justly preferred for the purpose of manufacture, to the purest and hardest variety of splint-coal. The latter I have found to average from 50 to 59 parts of carbone in the 100; and the soft, or mixed qualities of coal, from 45 to 53 parts. Such various proportions of carbone plainly point out that the operations to be followed at each individual iron-work ought not to rest upon precedent, unless borrowed from those works where exactly the same quality of coal is used. This analysis also lays open part of the source from whence originates the widely different quantities of metal produced per week at various blast-furnaces, and the great disproportions of ore used to different coals.

"Experience has shewn that the three qualities of coal just mentioned, will smelt and give carbonation to the following proportions of the same species of torrefied iron-stone:

112 lb. of clud-coal cokes will smelt	-	130 lb.
112 lb. of splint-coal cokes will smelt	-	105 lb.
112 lb. mixed soft and hard coal cokes will smelt		84 lb.

"Let the iron-stone be supposed in the blast-furnace to yield 40 per cent. then we find that the one-twentieth of a ton of the respective qualities of cokes will smelt and carbonate the following proportions of iron, viz. 112 lb. clod-coal cokes, 130 lb. iron-stone, at 40 per cent. = 52 lb. iron; 112 lb. of splint-coal cokes, 105 lb. of the stone = 42 lb. of iron; and 112 lb. soft and hard coal cokes, 84 lb. of the iron stone = $33\frac{6}{10}$ lb. of iron. We then have for the quantity of metal produced by one ton of each quality of cokes:

Clod-coal	52	× 20 =	1040 lb.
Splint ditto	42	× 20 =	840 lb.
Mixed ditto	$33\frac{6}{10}$	× 20 =	702 lb.

"This furnishes a datum whereby we easily obtain the

the quantity of the various cokes necessary to produce one ton of carbonated crude iron by common proportion: for if 1040lb. of metal are produced by one ton, or 2240lb. of clod-coal cokes, the quantity of the same cokes requisite for the production of one ton, or 2240lb. of metal will be—

		T.	C.	Q.	lb.
	4824.6lb.=	2	3	0	8
Splint-coal cokes	840:2240::2240:5973.3lb.=	2	13	1	9
Mixed ditto	702:2240::2240:7147.5lb.=	3	3	3	7

"If to the quantity of cokes necessary to manufacture one ton of crude iron, we add the quantity of volatile matter driven off in the process of charring, which may be thus estimated upon the average of each quality:

Clod-coal	$\frac{3}{8}$ or $37\frac{1}{2}$ per c. produce in cokes	$\frac{5}{8}$ *a* $62\frac{1}{2}$ per c.
Splint coal	$\frac{4}{8}$—50	$\frac{4}{8}$ or 50
Mixed coal	$\frac{5}{8}$—62,5	$\frac{3}{8}$—$37\frac{1}{2}$

"Then, for the quantity of the respective coals used in the raw state, we have the following results in proportion.

		T.	C.	Q.	lb.
Clod-coal	5 : 4824.6 :: 8 : $7719\frac{1}{4}$ =	3	8	2	19
Splint coal	3 : 5973.3 :: 8 : 11946 =	5	6	2	18
Mixed coal	3 : 7147.1 :: 8 : $16158\frac{2}{3}$ =	8	11	0	16

Difference of produce from different kinds of coal.

"These great disproportions of quantity, used to fabricate one ton, or 2240 averdupoise pounds of the same quality of crude iron, will convey a striking and impressive idea of the multifarious qualities of coal which may be applied and made to produce the same effects. It should also convince the manufacturer that the study and analysis of his own materials is the first and radical approach to true knowledge, and certainty of operation. Divest him of this knowledge, and view him guided by the customs and rules prevalent at another manufactory, where the coals and ores may be as different as has been already mentioned, and we will no longer wonder at the uncertainty of his results, and the numberless errors of his direction.

"Before I enter into the practical discussion of the application of coal, I beg leave to indulge myself in the following calculations:—We have already seen that the production of 2240lb. of carbonated crude iron requires 4824lb. of clod-coal cokes; these may be averaged to contain 4.5 per cent. of ashes, which, deducted from 4824, gives 4607lb. of carbone used for one ton of metal: this sum, divided by 2240, farther gives, for one lb. of cast iron thus manufactured, 2.056lb. of carbone.

"We next find that 2240lb. of the same metal requires of splint coal cokes 5973.3lb.; we farther find, from a table of the analysis of coal, furnished in a former paper, that 100 parts of the raw coal contained 4.2 parts of ashes. As it is there stated to lose 50 per cent. in charring, 100 parts of cokes will contain 8.4 of ashes; and 8.4 per cent. deducted from 5973.3, gives 5472 lb. of carbone. This again, reduced by 2240lb. gives for each pound of metal manufactured, 2.442lb.

"Again, 7147.1lb. of cokes obtained from soft mixed coals are consumed for every ton of 2240 averdupoise pounds of crude iron produced; every 100 parts of the same coals contain 3.3 parts of ashes; and 100 parts of cokes contain nearly 6.5 per cent. of ashes, which, deducted from 7147.3, gives 6672.6 of carbone, which divided by 2240, gives, for the quantity used for one pound of cast iron, 2.978lb.

"From these calculations it appears, that 2240lb. of carbonated iron, requires of carbone from clod-coal 4607lb.; of carbone from splint-coal, 5472lb.; and of carbone from mixed coal, 6672lb.: that one pound of carbonated iron requires of carbone from clod-coal cokes 2.056lb.; from splint, 2.442lb.; from mixed, 2.983lb.; and that carbonated crude iron may be obtained when widely different quantities of carbone have been consumed.

"In seeking for a solution of the latter fact, we must have recourse to the different degrees of inflammability of the carbone, according to the various laws of continuity imposed upon it in its fossil construction. It can easily be conceived, that owing to this structure, and the nature of the interposed ashes, the particles of carbone of some cokes will be more easily oxygenated than those of others; in the same way that we find splint-coal, when exposed to ignition in contact with open air, affords one-third of more cokes than are obtained from soft mixed coals, though the latter, when distilled, yield more pure carbone than the former.

By experiment it is proven that 100 grains of carbonic acid gas is composed of 72 parts of oxygen, united with 28 parts of carbone: if the quantity of the carbone of clod-coal, viz. 2.056lb. used for the manufacturing of every pound of cast iron, is reduced to grains, we will find it to consist of 14392 grains; this, divided by 28, gives the acidifiable principle of 514 $\times 100 = 51400$ grains of carbonic acid gas (F): hence as one cubic foot of this gas, at 29.84 of barometrical pressure, and 54.5 of temperature, weighs near 761 grains, we find that in the formation of every pound of cast iron $\frac{51400}{761} = 67.54$ cubical feet of carbonic acid gas will be formed; and in the production of one ton of metal, the astonishing quantity of 151289.60 cubic feet. This quantity, however incredible it may seem, is only what would be formed under the above pressure, and at the above temperature: when we take into the account the high temperature at which the decomposition and recombination are effected, with the consequent

(F) "This is supposing, for the moment, that the whole of the carbone is oxygenated, either by the oxygen contained in the ore, or obtained from the discharging-pipe by the decomposition of the atmospheric air: this, however, is not strictly true, as the metal takes up a small portion, by weight, of the carbone; and when, by accident, moisture has been introduced into the furnace, either through the medium of the blast, or of the materials, its decomposition furnishes a portion of both oxygen and hydrogen, which may dissolve, and also carry off, a part of the carbone. Atmospheric air being found to hold water in solution, a small quantity of hydrogen will, even in the driest weather, be present in the blast furnace.

Furnace.

quent increase of elastic force and of volume, our ideas are almost unable to commensurate the sum of the gas hourly formed, and thrown off, ignited to the highest degree of heat.

" If the same mode of calculation is adopted with the other qualities of coal, we will have the following results:

" For the splint-coal 2,442 lb. or $\frac{17094}{28} = 610{,}5 \times 100 = 61050$ grains of carbonic acid, which gives $\frac{61050}{761} = 82.85$ cubic feet for 1 lb. and $82{,}85 \times 2240 = 185.584$ cubic feet for one ton. For the mixed coal 2.983 or $\frac{20881}{28} = 710 \times 100 = 71000$ grains carbonic acid; that is, $\frac{71000}{761} = 93.3$ cubical feet for 1 lb.; and $93.3 \times 2240 = 208{,}992$ cubical feet for one ton. By the same calculation we may attain a pretty accurate notion of the quantity of atmospheric air necessary to produce 1 lb. or one ton of cast iron; an average of the three varieties of coal will be sufficiently accurate for this purpose; thus $\frac{14392 \times 17094 \times 20881}{3} = 17455\frac{2}{3}$ or 2.4935 lb. of carbone are consumed upon the average of each pound of pig-iron: this is found to produce of carbonic acid gas $\frac{17455\frac{2}{3}}{28} = 62.341 \times 100 = 62.30041$ grains; which again divided by 761, the grains in one cubic foot, gives 81.86 cubic feet for the gas discharged in manufacturing one pound of cast iron. As carbonic acid contains, as has already been noticed, 72 parts of oxygen in 100, then we have for the quantity of oxygen gas 100 : 72 :: 62400.41 : 44856.29 grains oxygen gas; and as, at the ordinary temperature and pressure of the atmosphere, a cubic foot of oxygen gas weighs 591 grains, we find 44856.29 divided by 591 = 75.89 cubic feet of oxygen gas necessary to form the acidifying principle of 81.86 cubic feet of carbonic acid gas; and that the same quantity of oxygen gas is necessary to the production of one pound of carbonated crude iron. This leads us to the following statement for the quantity of atmospheric air used during the same operation; first premising that the constituent parts of atmospheric air are nearly 73 of azote and 27 of oxygen gas; of atmospheric air then necessary, we have 27 : 100 :: 75.89 : 281 cubic feet.

" I shall now proceed from mere calculation to matter of fact, and attempt to prove the correctness of the former by the approximation of the latter to its results. Let a blast furnace be supposed to produce $20\frac{1}{2}$ tons of pig-iron per week, = 45360 avoirdupoise pounds; this divided by days, hours, minutes, and seconds, gives per day 6480 pounds, per hour 270, per minute $3\frac{1}{4}$ lb. and per second 525 grains.

" From this it is evident that one pound of cast iron is produced in $13\frac{33}{100}$ seconds; experience has shewn that a blast-furnace, producing, in any of the above periods, the respective quantity of metal, requires a discharge of air per minute nearly cqual to 1350 cubic feet; this, divided by 4,5 lb. the quantity produced per minute gives, for one pound of iron, 300 cubic feet. The quantity, by calculation, we have seen to be 281 cubic feet, difference 10; a sum no way considerable when we reflect upon the inequality of the movements of a blowing machine, and when it is recollected that some allowance ought also to be made for what air may pass through the furnace undecomposed, or may be lost at the place of entrance.

" From this coincidence of theory with practice, we cannot help admiring the rigorous principles on which the Lavoisierian system is founded; nor are we less pleased to find, that, small as the operations of the chemist may be, yet they are a just epitome of what takes place in the philosophy of extensive manufactories. The following table exhibits the quantity of carbone which may be used upon an average, with the relative quantity of carbonic acid formed, and air used:

" In the manufacture of	1 lb.—	1 ton of iron,
The pure carbone requisite is	2.49—	5585.44 lb.
Carbonic acid formed	81.86—	183366.40 cub. ft.
Oxygen gas used	75.89—	169993.60 cub. ft.
Atmospheric air employed	281.00—	629440.00 cub. ft.

" From the foregoing particulars upon coal may be learned how much is dependent upon the native construction of coal and its constituent parts; I shall next advert to the effects produced by its improper preparation.

Quality of well-charred c[...]

" When coals intended for the blast furnace are sufficiently charred, they ought, in point of colour, to be of a silver-gray: their fracture will appear lamellated and porous if splint-coals have been used; softer coals form themselves into branches slightly curved, and, when properly prepared, are always very porous. I have frequently found that the better the cokes were charred, the more water they will absorb. Coals half burnt do not take up half so much water, because their fracture continues in part to be smooth and less porous than when thoroughly burnt.

" When half-prepared cokes are introduced into the furnace, the metal formerly carbonated will lose its gray fracture, and approach to the quality of oxygenated iron. Their presence is easily detected by the unusual quantity of thick vapour arising along with the flame. Besides, the water and sulphur, which raw coals introduce into the furnace, and which always impair the quantity of carbone by the various solutions effected by the presence of oxygen, hydrogen, &c. the fitness of the coal for combustion, and the support of the ore, is much diminished by this second course of ignition and disengagement of bitumen. The pressure of the incumbent ores also fracture and reduce the cokes into small pieces, which produce a considerable portion of coke-dust; this is partly carried to the top of the furnace before the blast; sometimes below it appears in immense quantities, ignited to whiteness, and liquid as sand. Coal thus detached from the mass, exposed to the action of a compressed current of air, is unfit for conveying the carbonic principle to the metal; and as it frequently belongs to the just proportion of charcoal necessary to smelt the ores, and to carbonate their iron, its loss must be felt, and the quality of iron impaired.

Eff[...] cok[...] ly [...] ed [...] sor[...] wa[...]

" When cokes of any quality are exposed to a moist atmosphere, so as to absorb water, their effects in the blast furnace become much reduced, and the presence of the water is productive of the most hurtful consequences in the production of carbonated crude iron. I have found, by repeated experiment, that one pound of well-

well prepared cokes will, when laid in water, take up $1\frac{3}{4}$ ounce in the space of half an hour; at this rate, a basket of cokes weighing 80 lb. saturated with water, will contain 140 ounces of water, or $8\frac{3}{4}$ lb. If the charge contains six baskets, then we see that upwards of 50 lb. of water is introduced regularly along with the charge, furnishing an additional quantity of oxygen equal to $42\frac{1}{2}$ lb. and of hydrogen equal to $7\frac{1}{2}$ lb.; but it frequently happens that the cokes contain a larger portion of water than is here stated. When cokes thus surcharged are introduced in quantity into the blast furnace, the quality of the metal is not always instantaneously changed, and frequently the colour and form of the cinder remain long without any great alteration. The contact of wetted cokes with the ore is first seen by the great discharge of pale blue gas, with the whiter flame at the top of the furnace; next, the accumulating oxyde upon the surface of the pig when consolidating indicates their presence. Iron thus oxygenated frequently exhibits, while fluid, that agitation and delicate partings peculiar to carbonated metal: the remelting of this iron is never attended with advantage, and is always unprofitable to the founder.

"From the properties which have been assigned to pit-coal, the following facts may be deduced:—That charcoal is the basis of the manufacture of crude iron; that its proper application produces the most valuable quantities of pig-iron; that, by diminishing its relative proportion, or contaminating its quality by heterogeneous mixtures, the value and fusibility of the metal is lost; but, that, by a proper increase, and always in proportion to this increase, will the fusibility and value of the iron be mended. From the whole, an important lesson may be learned of the pernicious effects of water in the furnace, and how absolutely necessary it is to prepare the cokes without using water, either to damp the fires, as in the usual mode, or to cool the cinders obtained from the tar kilns, to prevent their consuming in the open air: in all this hurtful operation considerable quantities of water become fixed in the cokes, which require a very great degree of heat to expel.

"The preparation of iron stone has already been fully attended to, and the phenomena which it exhibits under every stage minutely described. In consequence of various experiments we are authorised to draw the following conclusions: That when pure calcareous iron-stone is used, it admits of having the local quantities of cokes diminished; that argillaceous requires a larger portion than the calcareous genus; and that siliceous iron-stone requires a greater proportion of fuel than any variety of the former genera. We have also seen that fusibility, either connected with strength or otherwise, is derived from the mixture of the ores; and that excessive brittleness, intimately connected with infusibility, is also derived from the same source. From a review of these facts, we are forcibly impressed with the importance of combining the prepared iron-stones with proportions of fuel suited to their various natures, in order to produce all the varieties of iron with the greatest possible economy. Contemplating farther the same subject, it is easy to be conceived that a want of knowledge of the component parts of iron-stones, and the effects which individually they produce, must lead to great uncertainty of operation in the smelting process, wherein the beautiful economy of nature, and even real property, will be often unprofitably sacrificed to precedent.

The oxygen of the iron-stone

"Besides the above causes of alteration, dependent upon mixtures of the earths, the existence of oxygen in various quantities in the ores ought never to be overlooked in proportioning the cokes to the iron-stone. This powerful agent, whose form and substance constantly eludes our vision; whose existence is only ascertained by the wonderful changes produced by its various combinations with the iron; and whose presence in the same iron-stone, in various quantities, may produce such variety of result as to characterise the ores, as containing *good* or *bad* iron, surely forms the most interesting mixture which ores or iron-stones possess. It will be a momentous epoch in the manufacture of iron when the existence of such a principle shall be fully admitted by the manufacturer, and its agency, from certain visible effects produced, adopted to explain its accompanying phenomena. Till that period he will not perceive the utility of ascertaining the quantity of oxygen, and devising economical methods of taking it from the ore. An attention to this powerful principle can alone root out those prejudices so inimical to the real interests of the manufacturer, and which seem to glance at nature, as having improvidently combined her most useful metal with mixtures which could resist the ingenuity of man, or set his comprehensive intellect at defiance. In the progress of this great inquiry, is it not possible that the present expensive exertions may in part be superseded? Is it not possible, that, by laying open the sources of information to individuals at large, a greater mass of intellect may engage in the practice of this art? While the present extensive and lofty buildings are necessary, the business is entirely confined in the hands of men of great capital: the extent of their manufactures require that a large tract of country be devoted to their supply; a natural consequence is, that innumerable tracts of land are overlooked, or held unworthy of notice, merely because they cannot, in a period necessary to clear a great capital and insure a fortune, afford the necessary supply of materials. Such situations, according to the present state of the iron business, must remain unexplored. Should, however, a desire for truth once gain footing in the manufactories of iron, and should this natural impulse of the unprejudiced mind keep pace with other branches of intellectual information, we may not despair of seeing many imperfections removed, which were the unavoidable consequence of the period of their creation.

"In the application of iron-stone in the blast furnace, the following particulars ought rigorously to be attended to:—

and its other qualities to be considered.

"1. Their mixture, whether clay, lime, or silex; their relative proportions to each other, judging according to the rules formerly laid down; which of them may admit of a diminution of fuel; which of them will afford the quality of iron at the time requisite; and which of them will be most likely, by a judicious arrangement, to give the greatest produce of metal, united with value and economy. Iron stones, united with large portions of silex, have already been stated to require a greater proportion of fuel to carbonate their metal than the other genera. When ballast or forge-pigs are wanted, it

Furnace. is obvious that siliceous iron-stones ought to be used; not that they contain a greater quantity of iron, but because they form a substitute for the other kinds, which may be more advantageously smelted for the production of more valuable qualities.

"2. The quantity of metal which each individual iron-stone may contain, is another object of consideration. Besides the proportion of mixtures, which chiefly contribute to the fusibility of iron-stones, a second degree of fusibility is dependent upon the richness of the ore in iron; this is so obvious in the use of the Cumberland and Lancashire ores, that the consequences of their introduction will be perceived, by the change of the scoria and metal, in half the time that change would be effected by ordinary iron-stones. It has been frequently noticed, that crude iron contained pure carbonic in proportion to its fusibility; then the more fusible or supercarbonated qualities must take up, comparatively, a considerable portion of the carbonaceous principle from the fuel. From this results a striking consequence, that the quantity of fuel should, over and above its relation to the mixtures, bear a just proportion to the quantity of iron in the stone: for example, let the weight per charge of fuel at a blast furnace be 400lb. and let this be supposed sufficiently to fuse and carbonate the iron contained in 360lb. of iron-stone; let the quantity of metal be supposed 35 per cent. then the produce will be 126lb. Should a change take place, and iron stone richer in iron be applied, though the same by weight, and should this iron stone yield of torrefied stone 45 per cent. its produce will be 162lb. or 40lb. more than the former. As there exists no greater proportion of carbone in the furnace, it is evident that the existing quantity, being distributed over nearly one-third of more metal, must therefore be in more sparing quantity in the whole, and the value of the metal consequently reduced.

Quantity of fuel to be proportionate to the richness of the ore.

"3. The weight of oxygen contained in iron stones is the next object of serious consideration. I have already shewn, from experiment, that our iron stones naturally contain from 9 to 14 per cent. of oxygen, which remains after torrefaction; it has also been shewn, that this quantity of hurtful mixture may be easily doubled by over-roasting or under-roasting the stone; and that the bad effects entailed are in the ratio of its combination with the iron. From a review of the facts which have been adduced on this subject, its agency and effects will easily be credited by men of science; its property of constituting the acidifying base of all the acids readily explains the unalienable consequence of its presence with acidifiable bases. The effects are still more pernicious when the oxygen is furnished by the decomposition of water in raw iron stone; the hydrogen in this case, set free, also seizes a portion of the carbone; and these abstractions, united to that produced by the native portion of oxygen in the stone, form an aggregate which frequently reduces the value of iron 40 per cent. So long as the principles of science are overlooked in the manipulations of the foundery and forge, the existence of such agents will be treated as chimeras of the philosopher and the chemist, and the effects hourly produced by them industriously attributed to causes which, in point of unity or consistency, will not bear the slightest touch of investigation*."

* Phil. Mag. vol. v.

The compression, velocity, and effects of the air are of the utmost importance in blast furnaces. The productions, management, and direction of these effects are therefore serious objects of consideration to the manufacturer of iron, since on their proper application the success of his operation chiefly depends. And here we shall renew our obligations to Mr Mushet for his interesting observations on this subject. "When it is considered," he says, "that in the smelting operation the reduction of immense quantities of materials is effected by a compressed current of air impelled by the whole power of a blowing machine, the consequences of the change of air, either in quantity or quality, must be very obvious: when, farther, we contemplate the metal called into existence by means of combustion thus excited; when we consider iron as having the most powerful affinity for the base of that part of the air which maintains combustion; and when we view the debased state to which the metal is reduced by coming into improper contact with it, we must conclude, that the application of blast in the manufacturing of iron calls for the most minute and thorough investigation. In order to take a comprehensive view of this subject, the following division will be requisite:—

"1st, The intimate connection which the quantity of blast bears to the area of the internal cavity of the furnace, and to the nature of the pit-coal.

"2d, The various modes by which air is procured, and how these respectively affect the quality of the air.

"3d, The various changes to which air is subjected by a change of temperature in the atmosphere, with the consequent effects.

"4th, How far increased or diminished velocity and compression alter the results of the furnace.

"5th, The form and diameter of the discharging-pipe.

"1st, Then, in the construction of a blast-furnace and blowing-machine, the quantity of air to be used ought to depend upon the internal dimensions of the former; which, again, ought to be formed according to the quality of the pit-coal. Upon the softness or hardness of the coal, ought more immediately to depend the height of the blast-furnace. This necessary precaution has given rise to a vast variety of furnaces, of different capacities, from 30 to 50 feet in height, and from nine to 16 feet diameter at the boshes. Furnaces from 30 to 36 feet are used for the softer qualities of coal, such as a mixture of free-coal and splint. Furnaces from 36 to 45 are appropriated to the burning of splint-coal cokes; and in Wales, such is the superior strength and quality of the pit-coal, that the furnaces admit of being reared to the height of 50 feet.

"These various qualities of coal, it has been formerly shewn, have appropriate weights of iron-stone, and, to use the language of the manufactory, are capable "of supporting a greater or less burden of mine." The former qualities admit not of having the air discharged in great quantity, unless it is impelled under an uncommon degree of compression and consequent velocity, incompatible with the operations of a steam-engine. The reason is obvious: when air, loosely compressed, or comparatively so, is thrown into a body of ignited fuel, the mechanical structure and continuity of whose particles are soft, the air is much more easily decomposed; the ignition, of course, is more rapid: the descent of the materials is promoted beyond their proper ratio, and long

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long before the carbonaceous matter has penetrated the ore, or united to the metal, to constitute fusibility. I shall adduce an example, as being the most illustrative of this doctrine.

Illustrated by example.

"Suppose a blast furnace, 35 feet high, 11 wide at the boshes, properly burdened, and producing No 1. pig-iron. Let the discharge of the air be supposed equal to a pressure of two pounds and a half upon the square inch, or equivalent to one-sixth of the atmosphere, or five inches of mercury: under these circumstances let it farther be supposed, that 1500 cubical feet of air are discharged in one minute; and that the diameter of the discharging pipe is 2.625, the area of which is equal to 6.890625 circular inches. Let the discharging pipe be increased to three inches diameter, and let the same quantity of air be passed into the furnace; it is evident that as the area of the discharging pipe is increased to nine circular inches, or nearly one-third more than formerly, the compression of air must be proportionally diminished. The alteration is soon perceived by its effects; the quantity of scoria increases from the furnace, whilst the consumption of the materials above is also considerably augmented. In a few hours the scoria will have undergone a complete change, from pure white, enamelled with various blue shades, to a green, brown, or black colour, considerably charged with the oxide of iron (G). The same effects will continue, in greater or lesser degree, till all the materials are reduced which were existing in the furnace at the period of diminished compression. The philosophy of this fact may be investigated in the following manner:—

"While the just association of proportions remained, the air was discharged under such a degree of compression as to excite proper combustion: the decomposition of the air by means of the ignited fuel, was not effected in immediate contact with the separating metal, but had, by its uncommon degree of density, resisted decomposition in the ignited passage, and had been decomposed upon the cokes at a greater elevation in the furnace. As a proof of this, we frequently see a tube formed throughout the whole breadth of the furnace, quite black and apparently cold, formed of the fused materials: when this is removed, a considerable descent momently takes place of cokes heated visibly beyond the common pitch: these inflame rapidly, but are soon again cooled to blackness by the incessant discharge of air upon them. The descending mixture of iron and lava is in like manner cooled along the line of blast; the tube is again formed, and, if not removed, will remain for days together, while the furnace will be otherways working in the best manner.

"When by accident or design the compression and velocity of blast are diminished, the tube begins to burn, and throws off a great many fiery-coloured sparks, the sides and roof fail, and are carried before the blast in all directions. Sometimes considerable clots of imperfect iron are recoiled with such violence as to escape the vortex of blast, and issue from the tuyere-hole with such velocity as to inflame the air, and fall down in the state of oxide. In the end the tuyere will appear to flame, and all the passage inwards shews an astonishing degree of whiteness. The decomposition of the air is instantaneously effected upon its entering the ignited passage; the iron by this means is exposed to the oxygen that is disengaged; and the vast quantity of caloric set free, in consequence of its union with the iron and carbone, produces the astonishing heat now visible, but which formerly took place at a more proper height in the furnace.

"From this it will appear, that although a greater apparent degree of heat is visibly produced by the sudden decomposition of the air, and a more rapid descent of materials for some time is the consequence, yet, as the quality of the iron is impaired, and as in the end the furnace will return to its old consumption of materials as to quantity, the effects of a loose soft blast are obviously pernicious.

Pernicious effects of moisture in the air or in the fuel.

"It sometimes happens, that when a loose blast is surcharged with a considerable portion of moisture, or comes in contact with cokes which had been wet when introduced into the furnace, the inflammation which takes place at the tuyere is prodigious: fine fire clay will be melted down and blown to slag in a few minutes; the sides of the furnace, composed of very infusible fire stone, are next attacked, and in a few hours will be so completely destroyed as to stop the working, and require immediate repair. Effects similar to those now described will be felt when the blast is improperly proportioned to coal of a stronger continuity of fracture and superior quality. Besides the effects produced by the sudden decomposition of iron, others of like nature are produced where a soft coal is used, a small furnace, and a great discharge of blast.

"It has been found that crude iron, to be properly matured, ought to remain in the blast furnace, according to circumstances, 48 to 60 hours; that is, from the period that the iron stone is introduced till such time as the metal begins to occupy its place in the hearth in a state of perfect separation. When the contrary is the case, the mixture arrives at the hottest part of the furnace before the metal has taken up a sufficient quantity of carbone from the fuel; the action of the blast, and the immediate heat by which the ore is surrounded, forces the iron from its connections to the bottom of the furnace. The quality is de-carbonated, and reduced in its value: to restore this again, the local portion of fuel is increased; this adds to the expence of manufacturing, and diminishes, in some measure, the smelting of the furnace.

"When splint-coal cokes are used in the blast-furnace, the blast admits of being thrown in under the highest possible pitch of compression; the uncommon density of the charcoal sustains a very powerful discharge of blast before it is dissipated to facilitate the general descent. Most frequently, large masses of these cinders pass through the whole ignited cavity, and are thrown out below, possessing all the acuteness of their original form and fracture.

"This quality of coal is used in all the Curson blast furnaces, where, to ensure a respectable produce, the air is discharged under a pressure equal to $3\frac{1}{4}$ pounds upon the square inch, or $6\frac{1}{2}$ inches of mercury.

Nn 2 "The

(G) "The metal will have lost nearly all its carbone, and have become inferior in value 25 to 30 per cent.

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"The same quality of coal was used at the Devon iron works, where at one time, having all the blast of a 48 inch cylider engine thrown into one furnace, the column of mercury supported was upwards of seven inches; the quantity of air discharged under such an impelling power, I found to exceed 2600 cubical feet per minute.

"The coals used at the Cleugh, Cleland, and Clyde iron works, are nearly of the same quality at each—a mixture of splint and soft coal. The Muirkirk and Glenbuck iron works have a coal different from any of the former, and in some particular spots it considerably resembles the English clod coal.

Methods of directing air into the furnace,

"2d, The various methods of procuring air for the blast furnace may be reduced to the following:—1st, That procured by cylinders, and discharged into the furnace by means of a floating piston heavily loaded, and working in a large receiver or regulating cylinder:—2d, That wherein pumping cylinders only are used, and the air thrown into chests inverted in water, called the *water vault*: 3d, That mode wherein the air is discharged from the pumping or forcing cylinder into an air-tight house, called the *air vault*.

by cylinders and water blowing machines;

"The first method is the original mode of blowing, and is still much used at those iron works whose erection has been prior to the last fifteen years. By this mode the quality of the air is less subject to alteration by a change of atmosphere. The principal objection to this manner of blowing, is the want of capacity in the receiving cylinder; which cannot be increased so much as to take away the considerable intervals which occur at different parts of the engine stroke. This effect is sensibly seen by the speedy and irregular ascent and descent of the column of mercury. In water blowing machines, where the air is raised by three or four cylinders worked by means of a crank, and where the air is received into an air chest, and forced into the furnace by the continual action of the blast of each successive cylinder, the current of the air is steady, and supports the column of mercury with great uniformity.

by means of the water vault.

"The use of the water vault has of late years become very general among new erected works. Its properties are, a steady and very cold blast: the largeness of the receiving cisterns gives them a sufficient capacity to retain every pound of air raised by the furnace, and distribute it to the greatest advantage. This is not the case with the floating pistons, where a certain quantity of spare wind is thrown out at every return of the engine, lest the great piston and weight should be blown out of the cylinder altogether; which, indeed, sometimes happens. The only objection which remains in force against the use of the water-vault, is the tendency which the air has to take up a considerable portion of water in solution, and introduce it into the furnace. A judicious arrangement of the conducting pipes would in some measure obviate this, as well as the more dangerous tendency which water has to rise in a pipe speedily emptied of its air by the stopping of the engine: a stream of water thus conveyed to the furnace would be productive of the most awful consequences.

The air vault.

"The air afforded by the air vault is much inferior to that obtained in the former methods. This immense magazine of compressed air generates a considerable portion of heat, which greedily seizes the damps, which are unavoidable in underground excavations, and conveys them to the furnace. The blast is, however, steady and uniform; and when the inside of the building is completely secured against the passage of air, it is productive of considerable effects in the furnace. In the summer months, however, the air becomes so far debased as to affect the quality of the iron, and change it from gray to white. Every change in the temperature of the atmosphere during this period, is indicated by various changes in the furnace.

"The largest air-vault hitherto in use was excavated out of solid rock at the Devon iron works; the fissures of the rock admitted considerable quantities of water; and the same degree of damp would always prevent the possibility of making the side walls and roof air-tight by means of pitch and paper, &c.

Quality and equality of the current.

"Besides the various natures of blast, as to the strength and equality of the current afforded by different modes of constructing the blowing machines, a variety in the quality of the air obtained is also an invariable consequence: this is sufficiently known by the effects which it produces in the blast furnace, and ought to be subject to scrupulous examination.

"In this, as in other countries, larger produces of cast iron are obtained in the winter months than during the summer and autumn seasons: the quality of the metal is also much more carbonated, and with a less proportion of fuel. In many parts of Sweden, where the summer heats are intense, the manufacturer is obliged to blow out or stop his furnace for two or three months: not only is he unable to make carbonated metal, but is frequently incapable of keeping the furnace in such trim as to make a produce of any quality whatever. In Britain, during the months of June, July, and August, more especially in dry seasons, the quality of the iron, with the local proportion of fuel, will be depreciated 30 per cent. and the quantity reduced to two-thirds or three-fourths.

"In seeking for a solution of this universally acknowledged fact, our attention is naturally directed to an examination of the various states of air. That the quality of the air in winter is more fit for combustion than in summer, is a truth which requires no farther demonstration. Greater coolness, whereby an almost complete refrigeration of moisture takes place, and the presence of perhaps a greater relative proportion of oxygen, may account for this phenomenon. On the contrary, the quality of air during the summer months becomes much contaminated for combustion, by holding in solution a much greater quantity of moisture: the abundance of nitrous particles may also diminish the usual proportion of oxygen.

"This will account for the inferior effects of combustion both in common fires and in the blast furnace; it will also in a great measure tend to solve the curious phenomenon of the pig-iron taking up less carbone in summer, although reduced with a superior quantity of fuel. The air discharged most probably contains less oxygen; yet the metal is much less carbonated than at other times, when contrary proportions of these exist. Most probably the deficient carbone is carried off by dissolving in hydrogen, forming a constant stream of hydro-carbonic gas, while the oxygen that is set free unites to the iron; and while it reduces its quality, at the

the same time the quantity is reduced by a portion of the metal being lost in the scoria (H).

"To correct these occasional imperfections in the quality of the air, and to devise methods to procure air always fit for proper combustion, ought to be an object of much consideration to the manufacturer of cast iron. Whether such a consideration has given rise to the different modes of receiving and discharging the air now in use, I cannot say; I rather think not: a great quantity of air has hitherto been a greater object than a certain and uniform quality; and in a country where there is more temperate and cold weather than hot, it is by far the most important object: to unite both, however, would be an attainment of the greatest utility, and would rank the discoverer amongst the well-deserving of his country. How far the mechanism of our present machinery has been adapted to the exigencies of our atmosphere, will appear upon examining the nature and properties of the air, judged by its effects upon the blast furnace.

"The air produced by the blowing and receiving cylinder is less changed, and less subject to change, than that produced and lodged in contact with a vast body of air or water. If the blowing cylinder is fixed in a dry cool spot, the only difference which the air undergoes is an increase of temperature; this is so very considerable, that upon entering the blowing cylinder immediately after stopping the engine, I have found the thermometer rise 15 to $17\frac{1}{2}$ degrees higher than the surrounding air. That this heat is generated in the cylinder is unquestionable; but whether it is occasioned by the friction of the piston leather upon the sides of the cylinder, or expressed from the air by its severe compression, I have not yet been able to decide. It very probably arises from both causes, although the latter is sufficient to produce a much greater degree of heat. What effect this increase of temperature has upon combustion we are unable to say, as the degree of heat accumulated will at all times bear a reference to the temperature of the surrounding air, and as there is no method likely to be devised where heat would not be generated by the action of the particles of air upon each other. When the bulb of a thermometer is held in the middle of the current of blast, as it issues from the discharging pipe, a temperature is indicated as much lower than the temperature of the surrounding air, as the temperature of the cylinder was higher; and it is most probable that a much higher degree would be obtained, were it not for the previous expression of some heat in the blowing cylinder. Upon the whole, I think, the quality of the air obtained in this way of blowing uniformly most fit for combustion, provided the numerous pauses and irregularities of the current of air were done away.

"Air forced into the furnace under water pressure always contains a considerable portion of moisture; the blast of course is colder, as it issues from the discharging pipe. The temperature differs so much from that of the external air as to sink the thermometer from 45° down to 28° and 30°. Such effects are produced by air coming into contact with water, that, although the temperature of the atmosphere is 60, 65, to 70, yet the blast at the orifice seldom rises above 38: the cold produced in this manner is much increased if the air is surcharged with so much water as to be visible in the state of a fine spray. The leading feature, therefore, of the water vault, as to its effects upon the quality of the air, seems to indicate an almost uniform degree of temperature in the blast: this can only be occasioned by the warm air in summer taking up a greater portion of the water in solution, the escape of which at a small orifice, and under a great degree of compression, produces the very great depression of the thermometer. I have already hinted at the bad effects produced by moist blasts, and shall, in a proper place, more minutely attend to them.

"The most inferior quality of air used in the blast furnace is that thrown into the air vault, and afterwards expressed from thence by its own elasticity and the successive strokes of the engine. The capacity of such a building is from 60 to 70,000 cubical feet; this, when filled, generates a much superior degree of heat to that sensible in the blowing cylinder. As this heat is produced many feet distant from any mechanical motion, it is most evident that it is extricated from the air, and will readily unite with the moisture which penetrates the building: the quality of the air introduced into the furnace will therefore be in proportion to the quantity of moisture taken up; this will be much more in summer than in winter, as the temperature of the former exceeds that of the latter. The sensation, on entering the air vault in the coldest months, immediately after stopping the engine, is exactly similar to that experienced upon entering a crowded room in the hottest summer day; the walls are covered with damp, and the superior regions of the vaults readily obscure the flame of a candle. The feeling, upon remaining in the air vault when the engine is at work, is less marked than would be expected where so great a compression of air existed; the sense of hearing, owing to the moisture in the conducting medium, is considerably impaired, and respiration is performed with some difficulty; the light of a candle is faint, and not visible at the distance of a few feet.

"I have explained the necessity of just proportions existing betwixt the area of the interior of the blast furnace, the quantity of air thrown per minute, and the quality of coal. The various modes of blowing, and their respective effects, deduced from strict observation, were also attended to. We have now, thirdly, to adduce examples where the various changes of the atmosphere, as to heat and pressure, occasion the most sensible difference in the quantity of materials consumed, and in the quality and quantity of metal produced.

"It has been already demonstrated, that the air in winter, by containing less moisture, is more proper for combustion, and more calculated to produce carbonated crude iron, than the air existing at any other season. From this superior quality the manufacturer obtains advantages, which induce him to wish for a continuance of

(H) "May not the superabundant azote of the summer atmosphere produce part of these effects, by dissolving a portion of the carbone, and forming carbonated azotic gas, as has been proved by M. Lavoisier."

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of cool air throughout the whole year. These effects are not, however, uniform; they depend greatly upon a light or heavy atmosphere. The keener and more still the air, the more rapid the combustion. During a severe frost, the descent of the materials is facilitated from one-tenth to one-fifteenth more than in rainy or hazy weather, and at the same time the quality of the iron is rather improved than impaired. When a change from frost to snow or rain takes place, the effects frequently become almost immediately obvious; the colour of the flame at the furnace head is changed; the tuyere of the furnace inflames, and burns with great violence; the lava, as it flows from the notch of the dam stone, becomes lengthened and tenacious; the form of it is changed, and the colour undergoes the most visible alterations; the iron no longer retains its complete saturation of carbone, but flows out sensibly impaired of its fluidity; and when cold, the privation of carbone is most evident by the examination of its fracture.

Effects of a change of weather.

"When such consequences arise from the transition so frequent in winter from frost to thaw, it will be easily conceived that the change effected during the milder and warmer months must produce proportionally additional effects. The increase of temperature by taking up, and holding in solution, a much greater portion of aqueous vapour, will account for the ordinary effects which are annually observable in every work. Where these pernicious consequences approach to extremity, a solution of the phenomenon will likely be obtained by the examination of the blowing apparatus. If air is fitted for combustion in proportion as it is free from watery solutions, we are not to expect similar results from these blast furnaces in summer, which are blown by air from the regulating cylinder, and those blown by air from a water or air vault. I have for years seen this fact verified, and superior quantity and quality of iron during the hot weather, obtained from a furnace excited by means of blast, from the simple regulating cylinder, with a less proportion of fuel, than from furnaces whose air was expressed by means of the water or air vault. Observations thus made, where every day the effects of the different means could be justly estimated and compared, have led me to the following conclusion: That the quality of the air, as furnished by nature in our atmosphere, is uniformly more fit for the manufacture of crude iron to profitable account, when discharged simply by means of cylinders and pistons, than when brought into contact with moisture either in the water vault or air vault.

Air from cylinders preferred.

"So imperfect has the quality of the summer air been found in this country for combustion, where the water vault was used, that experiments have been made to repair the deficiency of effect by introducing steam into the furnace by means of an aperture above the tuyere. The inducing motive to this act, was a belief, that combustion was diminished in consequence of a diminution of oxygen gas during the summer; that, by introducing water upon a surface of materials ignited to whiteness, decomposition would ensue, a larger quantity of oxygen would then be presented to the fuel, and superior effects, as to combustion, obtained in this manner than hitherto witnessed. The idea was ingenious, and, in its application to the manufacture of cast iron, original; but the whole train of facts, which have been detailed, as to the effects of a superabundant quantity of oxygen, was overlooked. The event proved in the most complete manner, and on a great scale, the pernicious effects of moisture. The furnace gradually became cooled where the steam entered; the heat, set free by the decomposition of the water and the disengagement of the oxygen, increased to an alarming pitch a considerable way up the furnace; the quality of the iron became brittle, and as white in the fracture as silver; the introduction of the steam was still continued, the descending materials were instantly robbed of their heat to facilitate the decomposition of the water, and by and by the furnace closed entirely over, and the experiment ceased.

"This experiment, performed in a furnace 18 feet high, is a complete proof that heat is disengaged from bodies while they pass from the fluid to the aëriform state. The first instant of the discharge of steam, a very considerable portion of heat would be withdrawn from the fusing materials and united to the water. This, in its turn, would be ignited to whiteness, and decomposed upon the metals and cokes, in a superior region of the furnace. The process continuing for several hours, the materials at the tuyere were at last so completely deprived of the caloric by the continual torrent of steam, that they lost fluidity, cooled rapidly, and at last became black. Had another aperture for steam and for air been opened above these, now entirely shut up by the consolidated materials, the same effects would have been produced; the immense quantity of caloric, disengaged by the decomposition of the ignited water, would now approach nearer to the top of the furnace, another stratum of fusing materials would again become consolidated, till in the end the whole furnace would be set fast from top to bottom. From the introduction of steam into the blast furnace, either as such, or under a superior degree of expansive force, the following important truths may be learned: That the quantity of oxygen which enters into our atmospheric compound is generally more fit for the manufacture of the superior qualities of crude iron than any mixture which may be furnished by the addition of water: that, although the decomposition of water, by furnishing a superior quantity of oxygen, and by throwing off a regular proportion of caloric, increases the effects of combustion immediately in the vicinity of this chemical analysis; yet, as the water had previously abstracted the heat necessary to its decomposition from the inferior strata, a greater quantity by no means exists in the furnace. The water, in fact, only serves as a medium to convey the heat from one particular spot; but, by attempting to fly off with it, meets decomposition, and renders up not only the abstracted heat, but that which was contained in the oxygen of its decomposition.

"4th, The compression and velocity of the air discharged into the furnace, considerably affect the results of the smelting operations. In the consideration of this subject, the various qualities of coals will be found to have an intimate connexion with the area of the discharging pipe and the compression of the blast. It has already been more than once observed, that a soft or mixed quality of coal is more susceptible of combustion than either the splint or clod coal: the consequence of this is, that, unless the necessary compression of air is used, decomposition is too early accomplished, and the cokes become oxygenated by combustion in a greater ratio

Com[pres]sion velo[city] the side

ratio than is proper for the carbonation of the metal. To avoid this, the column of air ought to be discharged, in the case of soft coals being unavoidably used, under such a degree of compression, as to resist entire decomposition in the ignited passage. In that case, the iron does not so immediately come into contact with oxygen, as the decomposition is chiefly affected in the superior strata of the separating materials. Under the former circumstance, of a loose unconnected stream of air being thrown upon cokes easily combustible, the quality of the metal, with the same quantity of fuel, becomes oxygenated, the tuyere becomes fiery, and frequently emits sparks of metallic oxyde. The separating iron may be viewed as it oozes from the ore in small globular masses, frequently on fire, changing its state to that of an oxyde. The combination of oxygen, by altering its density, makes it subject to the re-action of the blast, which at times gives it a direction from the tuyere with considerable violence. Those parts of the iron (by far the greatest) thus oxydated, which escape not at the tuyere, mix along with the fused earths of the ores and limestone, alter their colour, and flow from the furnace more unrevived than at their first introduction. It is, however, very different, even with this inferior quality of coal, where the density of the blast is proportioned to the inflammability of the fuel. Qualities and quantities of crude iron may be produced from this, equal to those from coals reckoned of a superior nature. The metal becomes as highly saturated with carbonic principle as that made from clod or splint coal. The tuyere evinces that decomposition is effected in its proper place. The fluid masses of iron, as they become expressed from the ore, are shivered into spray, before the dense column of air, without exhibiting the least symptom of decomposition. They again unite under the level of the blast, increase in size, and sink through the fluid stratum of earths to the bottom of the furnace. This fact holds out one of the strongest proofs of the great affinity which carbone and iron mutually possess towards each other. In the case of the iron separating in an oxygenated state destitute of carbone, it immediately falls a prey to its affinity for oxygen. In the latter case, the iron, being completely carbonated, resists decomposition by the sacrifice of a very small portion of its carbone. It further proves, that the affinity of oxygen is greater to carbone than to iron; and that, before iron becomes oxydated, all the carbone is taken up.

"The continuity of the particles of splint coals renders the cokes of difficult combustion, capable of withstanding a most powerful discharge of air, in quantity and in the degree of compression, without entailing effects similar to those produced with the use of softer coals: this renders the operations with splint coal less subject to casuality and to change. Carbonated iron with a proper blast is more uniformly obtained, and frequently a very superior quantity. Similar effects are produced with the clod coal, but in a more eminent degree. Discharging pipes are used four inches in the diameter, and the compression only equal to two pounds on the square inch; yet the same fatal effects are not known as in the use of soft coal, which, with such a column of air, would require the pressure to be equal to three pounds and a half upon the square inch at least.

"5th, Upon the form and construction of the discharging pipe effects of more considerable importance depend than is either generally allowed or even conceived. At some iron works, no peculiar shape is adopted: if the tube is sufficient to convey the air, and the mouth of it nearly of the size wanted, the interior construction is entirely overlooked. This indifference, however, is by no means general: variously constructed pipes are used at different works, and at some places it is preferred to throw in the air from two pipes whose areas are only equal to one of the usual size.

Form of the discharging pipe important.

"To understand properly the objectionable parts of the construction of nose pipes, it must be recollected, that much has been said to depend upon the blast reaching the opposite extremity of the furnace, as little impaired of the compactness and velocity of its original discharge as possible. When it is otherwise, the results in the internal operations of the furnace must be consequently altered. If the compression is diminished one-half or two-thirds when it reaches the opposite wall, decomposition in that portion must be effected before the air has attained its elevated situation in the furnace. It is even possible to disperse the whole column of air in such a manner that the ignited materials of the opposite side may receive little of its effects to promote combustion.

"A discharging pipe is frequently used, in length 12 inches or more, the discharging aperture 3 inches, the other end 5 inches; but this is arbitrary, depending upon the size of the adjoining pipe. From a pipe thus constructed, the air disperses or diverges too suddenly; and at a small distance from the orifice, a considerable portion of it answers but imperfectly the purposes of combustion. Part of it is speedily decomposed, and the oxygen brought into immediate contact with the iron. The quantity of metal is reduced by the former, and the quality injured by the latter. Though long custom, by a continued use of such shaped pipes, has prevented their pernicious effects from being observed, yet they must prove in many cases detrimental to the economical distribution of air, and the manufacture of iron.

"A nose pipe, of another construction, even more exceptionable, is also used; and the air disperses still more suddenly, in a degree somewhat proportionate to the more sudden contracting of the pipe, a considerable quantity never enters the furnace, but, striking on the exterior wall, is thence repelled.

Best form of construction.

"A discharging pipe, of the following construction, would obviate, in a great measure, the imperfections of the two former: the length of the tapered piece is 12 inches, of the straight pipe, six inches; extreme diameter, as in the others, five inches; diameter of straight pipe, three inches. From such a pipe it is conceived that the blast will proceed to the greatest possible distance unimpaired in compression and velocity. So far, therefore, as the absolute force of the blast and breadth of the furnace will permit, decomposition will be prevented on the level of the pipe, and the manufacturer freed from the evils which I have above detailed, as attendant upon decomposition in that quarter."

Description of an air and water vault.

The following is a description, also taken from Mr Mushet, of an air and a water vault which is employed to equalize the discharge of air into a blast furnace.

Fig. 7.

"Fig. 7. represents a vertical section of the elevation of an air vault 60 feet long and 30 feet wide, consisting of

Furnace.

of four arches of regularly progressive sizes. This building is generally constructed under the bridgehouse, where the materials are daily collected for filling the furnace. AB, represents the acclivity to the furnace top. The space betwixt the arch tops and the level of the floor is filled with materials as dense as can be procured. The walls of the under part are three feet thick, besides a lining of brick and plaster from 18 inches to two feet. Still further precautions are necessary, and alternate layers of pitch and stout paper are requisite to prevent the escape of the compressed air. C, a view of the arched funnel which conveys the air from the cylinder to the vault. Large iron pipes with a well fitted door are preferable, and less apt to emit air. D, an end view of the pipe by which the blast is carried to the furnace.

Fig. 8. "Fig. 8. is a horizontal section of fig. 7. at the dotted line *ab*, representing the width of the cross arches, which are thrown in each partition to preserve an easy communication betwixt the vaults. D, is a section of the first range of pipes, meant to conduct the air to the furnace. In like manner pipes may be taken off from any part of the vault for the different purposes of blowing furnaces, fineries, hollow fires, &c.

Fig. 9. "Fig. 9. represents a vertical longitudinal section of what is generally called the water-vault. The walls of this building may be erected to the height of eight or nine feet, their thickness similar to those of the air vault. A brick lining, and even puddling with clay betwixt it and the stone building, is necessary to prevent the water from oozing by the accumulated pressure. A, is an end view of the horizontal range of pipes which conveys the blast from the blowing cylinder to the inverted chest. BBB, the range which conducts the air to the interior of the inverted chest, and conveys it to the furnaces, proceeding along the extremities of the columns broken off at BB. C, an inverted chest made of wood, iron, or even of well-hewn flags set on end and tightly cemented, is 54 feet within in length, 18 feet wide, and 12 feet high. The dimensions, however, vary at different works. When the chest is made of wood or iron, it is generally bolted by means of a flange to the logs on which it is supported, lest the great pressure of the air should overcome the gravitation of the chest, and displace it. DD, view of the centre log, and ends of the cross logs, on which the chest is laid. These should measure 18 inches in height, so as that the mouth of the chest may be that distance from the surface of the floor, and the water allowed to retreat from the interior of the chest with the least possible obstruction. EE, the outside walls of the building. FF, the brick-works, made perfectly water-tight. The dotted line G, represents the surface of the water when at rest. Let the depth of the water, outside and inside of the chest, be estimated at four feet. When the engine is at work, should the pressure of the air have forced the water down to the dotted line H, three feet and a half distant from the line G, and only six inches from the mouth of the chest, it follows, that the water must have risen in the outer building, or chest, three feet and a half above G, and have its highest surface nearly at rest at I. In this case the strength of the blast is reckoned equal to seven feet of water, or nearly six inches of mercury. The space betwixt the chest and outside building is three feet. When the engine is at rest, and the water has assumed its level, the quantity of water within the chest should be equal to that without.

Fig. 10. "Fig. 10. is a ground plan of fig. 9. The cross logs on which the cistern is supported are dotted within, but drawn full in the space betwixt the flange of the chest and outer building. The breadth of the flange-tops of the binding bolts, and thickness of the metal of the chest, are also drawn. The letters bear a reference to those in fig. 9."

Singular phenomena observed in an air vault.

An account of some curious phenomena observed by Mr Roebuck in the air vault of a blast furnace has been published in the 5th volume of the Transactions of the Royal Society of Edinburgh. This, as well as some remarks of practical utility on the management of blast furnaces, we doubt not, will be interesting to our readers. We shall therefore give it in his own words. It is addressed in the form of a letter to Sir James Hall.

"I have (says he) examined my memorandums, concerning the observations I made on the condensed air in the air vault of the Devon iron works, near Alloa, on the north side of the frith of Forth; and, according to your request, I now transmit you an account of them; and also of an experiment I made, when a partner and manager of these works, in order to increase the produce of blast furnaces."

The two blast furnaces at Devon are of large dimensions, each being 44 feet high, and about 13 feet wide in the boshes, or widest part, and are formed on a steep bank, by two pits sunk in a very solid stratum of coarse-grained freestone.

These pits were afterwards shaped and lined in the usual manner of blast furnaces, with common bricks and fire bricks, and the hearth was laid with large blocks of the stone that had been dug out, and which serve the purpose of fire stones. At the back of the two furnaces, next the bank, the air vault is excavated, and formed by a mine driven in the solid rock, distant from the furnaces about 16 feet. The bottom of the air vault is only about four feet higher than the level of the bottom of the furnaces. This vault has an aperture at one end to receive the air from the blowing machine, and has two at the opposite end, one of which receives the eduction pipe, and the other is a door to give admittance occasionally into the vault. As the rock is extremely close and solid, the vault is dry, except that a little water oozes very gently from the side next the bank in small drops, and does not appear to exceed an English pint in 24 hours.

These furnaces are provided with air, or blast, as it is termed, by the means of a fire-engine of the old, or Newcomen's, construction. The diameter of the steam cylinder is $48\frac{3}{4}$ inches; and the square area of its piston being about $1866\frac{1}{2}$ square inches, the power of this sort of engine cannot be rated at more than 7lb. to the square inch, amounting in all to about 13062lb. This power was employed to work an air pump, or blowing cylinder, of 78 inches diameter, and about seven feet long. The number of square inches on the piston of the air pump is 4778, and therefore this area, being multiplied by $2\frac{3}{4}$, will produce 13139, being a resistance that nearly balances the above-rated power, and shews that the air, which was expelled from the air pump, could not be condensed more in the ordinary way

way of working, than with a compressing power of about $2\frac{3}{4}$lb. on each square inch. As the engine was not regulated, at first, to make a longer stroke than about four feet eight inches, only one furnace being used, the quantity of air expelled at each stroke of the machine was about 155 cubic feet, which it discharged through a valve into the air vault, about 16 times in a minute. When two furnaces afterwards were blown, the engine was regulated to work much quicker, and with a longer stroke. The air vault is 72 feet long, 14 feet wide, and 13 feet high; and contains upwards of 13,000 cubic feet, or above 80 times the contents of the air pump. The top, sides, and bottom of this vault, where the least fissure could be discovered in the beds of the rock, were carefully caulked with oakum, and afterwards plastered, and then covered with pitch and paper. The intention of blowing into the vault is to equalize the blast, or render it uniform, which it effects more completely than any machinery ever yet contrived for the same purpose. The air is conducted from the vault by the eduction pipe, of 16 inches diameter, into an iron box or wind chest, and from this it goes off to each furnace, into smaller pipes that terminate in nozles, or blow-pipes, of only $2\frac{1}{2}$ to $3\frac{3}{4}$ inches diameter, at the tuyere of the furnace.

Di[...]sions of [...] air va[...]

"When the furnace was put in blast, after having been filled with cokes, and gently heated for more than six weeks, the keepers allowed it to have but little blast at first, giving it a small blow-pipe of about $2\frac{1}{4}$ inches diameter, and likewise letting off a very considerable quantity of air, at the escape or safety valve on the top of the iron wind chest, as it is a received though erroneous opinion among them, that the blast must be let on very gradually for several months. From the construction of this valve, it was impossible to ascertain the exact proportion of the blast which was thus lost, but I believe it was very considerable. The consequence was, that the furnace, after it had been in blast for several days, never seemed to arrive at its proper degree of heat, but was always black and cold about the tuyere in the hearth, and appeared in danger of choking, or gobbing as it is termed.

Tri[...] of the furn[...] fail[...]

"After various experiments tried in vain, by the keepers and the company's engineer, and others, (indeed they tried every thing, except giving the furnace a greater quantity of air, which, as I afterwards ascertained, was all that it wanted), they concluded, that the air vault was the cause of the whole mischief; and to confirm their opinion, they said they had now discovered that water was, in considerable quantities, driven out of the air vault through the blow-pipe, which cooled the furnace; and they insisted, that the power of the engine was such as to force water out of the solid rock; so that this method of equalizing the blast never would succeed. The other managing partner was so much alarmed by these representations, that he began to consult with the engineer, and others, about finding a substitute for the air vault at any expence.

"As the plan of the blowing apparatus had been adopted at my recommendation, and was now so loudly condemned on account of the water, I had other motives, than mere interest, for trying to become better acquainted with the phenomena attending it. I accordingly determined to go into the air vault, and to remain inclosed in the condensed air while the engine was blowing the furnace. It is an experiment that perhaps never was made before, as there never existed such an opportunity. I could not persuade the engineer, or any other of the operative people about the work, to be my companions, as they imagined that there was much danger in the experiment. Mr Neil Ryrie, however, one of the clerks of the Devon company, had sufficient confidence in my representations to venture himself along with me.

[...]e causes [...]esti[...]ted.

"The machine had been stopped about two hours previous to our entering the vault, and we found a dampness and mistiness in it, which disappeared soon after the door was shut fast upon us, and the engine began to work in its usual manner. After four or five strokes of the engine, we both experienced a singular sensation in our ears, as if they were stopped by the fingers, which continued as long as we remained in the condensed air. Our breathing was not in the least affected. I had no thermometer with me, but the temperature of the air felt to us the same as that without the vault. Sound was much magnified, as we perceived, when we talked to each other, or struck any thing; particularly, the noise of the air escaping at the blow-pipe, or waste-valve, was very loud, and seemed to return back to us. There was no appearance of wind to disturb the flame of our candles; on the contrary, I was surprised to find, that when we put one of them into the eduction pipe, which conveys the wind from the vault to the furnaces, it was not blown out. There was not the smallest appearance of any drops of water issuing out of this pipe. The oozing and dropping of water from the side of the rock, next the bank, seemed the same as before the condensation was made in the vault. In short, every thing appeared, in other respects, the same as when we were in the common atmosphere. Having remained about an hour in the condensed air, and satisfied ourselves that no water, during that time, that we could in the least discover, was agitated and forced out of the rock and vault by the power of the blast, as was imagined and insisted on, we gave the signal to stop the engine. As soon as it ceased to work, and the condensation abated, and before the door of the vault was unscrewed, the whole vault in a few seconds, became filled with a thick vapour, so that we could hardly see the candles at four or five yards distance. The door being now opened, the work people, anxious to know our situation, and what had occurred, came into the vault, and prevented any further observations.

Phenomena in the air vault, and peculiar sensations of persons within it.

"I now endeavoured to account for this curious appearance of the water, which only showed itself occasionally, in very small quantities, at the tuyere, at a hole I ordered to be made at the bottom of the wind chest to collect it more accurately, for it never was observed, but either when the engine, after working slowly, was made to work quicker, or, after having been stopped for a few minutes, was set to work again.

"I considered the vapour which we had discovered in the vault to arise from the moisture of the side of the rock next the furnace, which being expelled by the great heat of the furnace, and converted into vapour, was able to force its way through the pores of the rock into the vault, but that being in a manner confined within the rock, by the pressure of the condensed air, it found itself at liberty to come into the vault,

The vapour observed in the vault accounted for.

Furnace.

vault, only when the condensation abated considerably, or was totally removed by the going slow, or stopping of the engine. It also occurred to me, that the air, in a state of condensation, might possibly be capable of holding a greater quantity of water in solution, which might precipitate suddenly into vapour or mist when the condensation abated. I imagined, therefore, that the very small quantities of water we at times discovered, proceeded from nothing else but this vapour, in its passage to the furnace along with the blast, being condensed into water, by the coolness of the eduction pipe and iron wind chest. The quantity of water did not appear to amount to a gallon in twenty-four hours.

"A few days after I had made this experiment, the water ceased entirely to make its appearance, either at the tuyere, or at the hole in the wind chest, but the furnace did not come into heat for a long while after, and indeed not till the keepers let much more air into it by a larger blow-pipe, and allowed less air to escape at the safety valve. It is probable that the rock was now become perfectly dry by the continued heat of the furnace.

"My experiment had the good effect to remove all the prejudices against the plan I had adopted of blowing the furnaces, and likewise prevented the other partner from laying out a large sum of money, by stopping the works, and altering the blowing machinery. Indeed, it has since been admitted, by all who have seen it at work, to be the most simple and effective method of equalizing the blast which has yet been put in practice.

Wind gage applied and its effects.

"This experiment led me, some time afterwards, to apply a wind gage that I contrived, to ascertain precisely the state of the condensation of the air thrown into the furnaces. I found that a column of quicksilver was raised five inches, and sometimes, though seldom, six inches, and, in the interval of the engine to receive air into the air pump, it fell only half an inch. At this time only one furnace was worked. But when two furnaces were in blast, the engine only raised the mercurial gage about four inches, because the Devon company, for several reasons, did not, while I continued a partner, think proper to allow the blowing machinery to be completed, by putting to work their second boiler of 20 feet diameter for the fire engine, according to my original design, which, by adjusting the machinery, would have enabled us to blow two furnaces with two boilers, with as much effect, in proportion, as one furnace with one boiler. This instrument had the advantage of enabling the work people to discover the real power of their blast, and know the exact condition of the air valves, and the gearing of the blowing piston; for if these were not tight, and in order, (although the engine might, to appearance, be doing well, by making the same number of discharges of the air pump as usual per minute), yet the wind gage would not rise so high, and would shew that there was an imperfection somewhere, by reason of a quantity of air escaping at the valves, or piston, that could not so easily otherwise be known. This contrivance was considered as of much use, and was afterwards always quoted in the company's journal books, to show the actual state of the blowing machine, in comparing the daily produce of the furnaces.

"I hope you will not think me tedious, when I explain to you another experiment, which appears to me to be of considerable importance to all manufacturers of cast iron.

"I had reason to conjecture, from my own observations on the effects of blowing machinery on blast furnaces, as well as from the knowledge I had acquired from my father Dr Roebuck, and from my communications with other experienced iron masters, that a great part of the power of such machinery was misapplied in general practice, by throwing air into furnaces with much greater velocity than necessary, and that, if this velocity was, to a certain degree, diminished, the same power, by properly adjusting the blowing machinery, of whatever nature, would be capable of throwing into the furnace a proportionally greater quantity of air. For, *Since the quantities of any fluid, issuing through the same aperture, are as the square roots of the pressure;* it follows, that it would require *four* times the pressure, or power, to expel *double* the quantity of air, through the same aperture, in the same time; but if the area of the aperture was doubled, then the quantity of air expelled by the same power, and in the same time, would be increased in the ratio of the square root of 2 to 1, though its velocity would be diminished exactly in the same proportion. Again: I considered that the quantity and intensity of heat, produced in blast furnaces, and consequently its effects in increasing the produce, might be only in proportion to the quantity of air decomposed in the process of combustion, without regard to its greater velocity; that is to say, whether or not the same quantity of air was forced, in the same time, into the furnace through a small pipe, or through one of larger dimensions; for, in attending to the process of a common air furnace for remelting of iron, where there is a very large quantity of air admitted through the large areas between the bars, it is well known, that a much greater intensity of heat is produced than takes place in a blast furnace; and yet the air does not enter into the fire through the bars with increased density or great velocity. I therefore thought it probable, that increasing the *quantity* of air thrown into the blast furnace in a considerable degree, although the *velocity* or *density* might be much less, would have the effect of increasing its heat, and operations, and produce. And as, from the principles above stated, with regard to the machinery, I saw I could greatly increase the quantity of air thrown into the furnace, by enlarging the diameter of the blow pipe, and regulating the engine accordingly, without being obliged to employ more power, I was anxious to make this experiment.

The velocity of blast, and its quantity considered.

"A system of management, of which I did by no means approve, was adopted by the other partners of the Devon company, soon after the works were begun to be erected; and, in the prosecution of it, they ordered their second furnace to be put in blast, without permitting those measures to be taken that were necessary to provide and maintain a sufficient stock of materials; and also without allowing their blowing machine to be completed, according to the original design, by the addition of its second boiler. As might have been expected, a trial of several months to carry on two furnaces, with only half the power of steam that was necessary, and an inadequate stock of materials, proving unsuccessful,

unsuccessful, the company, as a remedy, instead of making up the above deficiencies, ordered one of the furnaces to be blown out, and stopped altogether. This improper measure, however, afforded me the opportunity of immediately putting in practice the plan I have mentioned.

"When one of the furnaces was stopped, the other continued to be blown by a blow-pipe of $2\frac{1}{4}$ inches diameter, and the produce of the furnace, for several weeks thereafter, was not 20 tons of iron per week at an average. The engine at this time was making about 16 strokes a minute, with a stroke of the air pump, about 4 feet 8 inches long; but when I altered the diameter of the blow-pipe, first to 3, and immediately after to $3\frac{1}{4}$ inches diameter, and regulated the working gears of the engine, so as to make a stroke of 5 feet 2 inches long, and about 19 strokes in a minute, on an average, the produce was immediately increased. It continued to be, on an average of nine months immediately after this improvement, at the rate of 33 tons of iron per week, of as good quality as formerly: for, during this period, from the 21st November 1795 to July 30, 1796, this one furnace yielded 1188 tons of iron. No more coals were consumed in working the blast engine, or other expences about the blowing machine incurred, and therefore no more power was employed to produce this great effect. It is also of much importance to remark, that the consumption of materials, from which this large produce was obtained, was by no means so great as formerly. The furnace required very considerably *less fuel, less iron stone, and less limestone*, than were employed to produce the same quantity of iron by the former method of blowing; and according to the statements made out by the company's orders, as great a change was effected in the economical part of the business.

and established by experiment.

"From the success of this experiment, so well authenticated, and continued for several months, I am led to be of opinion, that all blast furnaces, by a proper adjustment of such machinery as they are provided with, might greatly and advantageously increase their produce, by assuming this as a principle, viz. '*That with the given power it is rather by a great quantity of air thrown into the furnace, with a moderate velocity, than by a less quantity thrown in with a greater velocity, that the greatest benefit is derived, in the smelting of iron stones, in order to produce pig-iron.*' However, it is by experiment alone, perhaps, that we can be enabled to find out the exact relations of power, velocity, and quantity of air requisite to produce a *maximum* of effect (1)."

In order to illustrate what is said above, a ground plan of the air vault and furnaces of the Devon Iron Works is given in Plate CCXXVI.; of which the explanation follows.

Explanation of Fig. 11.

Fig. 11.

A, The air vault, formed by a mine driven in the solid rock of coarse-grained freestone.

B, The blowing cylinder.

C, The pipe that conveys the air from the blowing cylinder to the air vault.

D, The reduction pipe that carries the air from the air vault to the iron wind-chest.

E, The iron wind chest (about $2\frac{1}{2}$ feet cube), in which is inserted a wind-gage, represented in fig. 12.

FF, The two blow-pipes for each furnace, which terminate in apertures of $3\frac{1}{4}$ inches diameter at the tuyeres of the furnaces.

GG, The two blast furnaces, placed in two pits sunk in the solid rock.

HH, The tymps of the furnaces from whence the cast iron is run off into the casting room, LL.

O, The door to give occasional admittance into the air vault.

M, The excavation, in which is placed the blowing machine.

Explanation of Fig. 12.

Fig. 12.

A, The end of the wind-gage (about 12 inches long), which is open to the atmosphere, being half filled with quicksilver.

B, The end that is inserted in the iron wind chest, and exposed to the pressure of the condensed air of the air vault.

Description of an air furnace.

To Mr Mushet we are also indebted for the following account of air furnaces, which are employed in iron founderies for the purpose of casting large pieces of ordnance, and other heavy articles.

These furnaces, he observes, "are employed for melting pig iron with the flame of pit coal. Furnaces of this kind are constructed of various sizes according to circumstances. The small sizes will run down from

seven

(1) "If Q be the quantity of a fluid, issuing in a given time through an aperture of the diameter D, V its velocity, and P the power by which it is forced through the aperture: then the area of that aperture being as D^2, the quantity of the fluid issuing in the given time will be as VD^2, or $VD^2=Q$.

"Again, this quantity multiplied into its velocity, will be as the *momentum* of the fluid expelled, or as the power by which it is expelled, that is, $V^2 D^2=P$, or $VD=\sqrt{P}$.

"Here, therefore, if D is given, V is as $\sqrt{P}$, as Mr Roebuck affirms. Also, because $V=\frac{Q}{D^2}$, and also $V=\frac{\sqrt{P}}{D}$, $Q=D\sqrt{P}$, so that, while P remains the same, Q will increase as D increases, and V will diminish in the same ratio.

"The problem, therefore, of throwing the greatest quantity of air into the furnace, with a given power, strictly speaking, has no *maximum*, but the largest aperture of which the engine can admit must be the best. It is probable, however, that there is a certain velocity with which the air ought to enter into the furnace; this will produce a limitation of the problem, which, as Mr Roebuck suggests, is not likely to be discovered but by experiment." *Note by Mr Playfair.*

Furnace. seven to ten hundred weight, and are used in small founderies for what the trade call *jobbing*.

Plate CCXXVI. fig. 13. "Fig. 13. (Plate CCXXVI.) a ground plan of two large air furnaces, and chimney for melting pig or cast iron with the flame of pit coal.

"The letters ABCD point out the exterior dimensions of the stalk or chimney, which is first erected, leaving two openings or arches into which the fore-part of the furnaces are afterwards built. The breadth of the chimney at the particular place which the plan exhibits is 16 feet from A to B, and from A to D or from B to C six feet six inches. The plan is drawn at that elevation where the flame enters the chimney by the flue or throat, narrowed on purpose to throw back part of the flame, and keep the furnace equally hot throughout, as may be more particularly viewed in the vertical section, fig. 14.

"EE, the furnace bars on which the coals rest, and where the combustion is maintained.

"FF, openings called teasing holes, by which the coals are introduced to repair the fire.

"GG, fire brick buildings called bridges. These are meant to concentrate the flame, that it may act as violently on the metal as possible. Upon the height of the bridge much depends in fusing the metal speedily, and with little loss. The height of this may be seen in the vertical section, fig. 14. G.

"HH, the charging doors, by which the metal is introduced in the shape and state of pig iron, lumps, scraps, &c. &c. The iron generally occupies the furnace across to I, called the back wall, and is never meant to approach the bridge nearer than the dotted line, lest the metal in melting should run back into the grates, in place of descending into the general reservoir or cavity below. The corners or notches, *h*, *h*, *h*, *h*, receive a stout cast iron frame lined with fire bricks. This is hung by means of a chain and pulley, and can be raised and depressed at pleasure. This frame is, properly speaking, the charging door, and is always carefully made air tight by means of moistened sand.

"KK, the flues or openings by which the flame enters the chimney. These are 15 inches by 10. On maintaining these openings of a proportionate size to the other parts depend in a great measure the powers and economy of the furnace.

"LL, lading doors, by which ladles are introduced, in the case of small furnaces, to lift out the metal and distribute it to the various moulds.

"MMMM, binding bolts to limit within proper bounds the expansion which takes place in the building when the furnace is highly heated.

Fig. 14. "Fig. 14. vertical section of one of the furnaces, and its appropriate stalk or chimney.

"E, the grates.

"F, the teasing hole.

"G, the bridge.

"H, the charging door.

"K, the flue or opening into the chimney.

"L, the lading door.

"MM, the binder or binding bolt.

"N, the interior of the stalk or chimney, 30 inches square.

"OO, the fire brick work, nine inches thick.

"PP, space of two inches for stuffing with sand.

"QQ, common brick building.

"RR, cast iron lintels, over which are thrown double nine inch arches, so that at any time the inferior building can be taken down to make repairs, without shaking or in the least injuring the chimney.

"S, The dotted lines here are meant to represent what is called the tapping hole. When a large piece of goods is to be cast, lifting the metal with ladles would be impracticable. A sharp-pointed bar is driven up this opening. The iron then flows freely out into a large bason of sand made for its reception. It is then conducted, by collateral channels, into the mould.

"The space under the curved dotted lines from G to L, by S, is filled with a mixture of sand and ashes. When the surface is prepared to melt, the whole of the bottom receives a stratum of sharp clean sand about two inches thick. This is broken up at night, and fresh sand is substituted for it before the fire is kindled in the morning.

"Fig. 15. is a horizontal section of the chimney or stalk, taken where the flues assume a perpendicular direction. The letters in this figure correspond to those in the vertical section, fig. 14. The height of the chimney ought not to be less than 45 feet: if 50 feet, the effect will be sooner and of course better produced. Fig. 15.

"The effect wished to be produced in air furnaces is the fusion of a certain portion of pig or cast iron, for the purpose of being poured or run into moulds to form articles of almost every description.

"The preparation previous to melting is as follows: After the bottom of the furnace is laid, and smoothed with fresh sand, and all the openings made air tight, the furnace man introduces a kindling at the teasing hole, accompanied with new pit coal. In a few minutes a considerable volume of dark flame mixed with smoke is produced. The fire quickly gathers strength; more coal is introduced; and the furnace now becomes filled with a yellow-coloured flame. By continuing this operation for an hour, or an hour and a quarter, the furnace and flame will have become completely white; the latter steady, and at times apparently without motion. The furnace man now judges the bottom to have been sufficiently hardened for receiving the pig iron without any risk of sinking. The charging door is now opened, and the pig metal thrown carefully and regularly upon that part of the bottom formerly described as being appropriated for its reception. The door is again closed and made air tight, and the operation of firing continued with unremitting care and attention. Preparation of furnace.

"The time of melting depends entirely upon the quantity of metal introduced. The furnaces described above are capable of melting from 50 to 60 hundred weight of metal each, and when there is a moderate circulation of air they will perform this work in $2\frac{1}{2}$ or 3 hours. In half an hour after the metal is introduced it assumes a blackish red colour. It then begins to brighten with every additional fire, and in about one hour appears white, and begins to lose shape, and resemble a wreath of snow.

"An eye accustomed to such heats will now discern the metal beginning to drop, and run down the inclined plane in very beautiful streamlets resembling quicksilver. Eight or ten of these are visible at a time, and after proceeding half way down begin to form junctions with

 with each other, and flow connected into the general cavity or reservoir. By-and-by this becomes filled, and literally forms a beautiful molten mirror, in which sometimes part of the interior furnace is reflected.

"The furnace man, by searching at the bridge with his fire-iron or teaser, judges when the metal is nearly all gone. Of this he is certain by looking up from the peep-hole of the lading door. If the streamlets of the running metal have ceased, then the whole is melted, and ready for running out.

Circumstances to be attended to during the operation.

"In the operation of melting, the three following circumstances ought to be particularly attended to: the thinness or hotness of the metal; the waste or loss sustained in melting; and the quantity of coals employed.

"The first is of the utmost importance, as many articles in the foundery business require the metal in a state of the greatest division; otherwise they will be found imperfect when taken from the sand, and unfit for sale. The furnace man, therefore, is always on the watch to replace the fire as it decays, and keep a large and sharp volume of flame constantly passing over the metal.

"The waste or loss of real metal is also an object of great importance. This always bears a relation to the quality of the iron, the strength and cleanness of the coals, and the judgment and attention of the melter. Strong iron is found always more difficult to fuse; this necessarily exposes it for a long period in contact with the flames. The reverse happens with metal that is more fragile, and easier broken in the pig. The length of the exposure in fusing depends on this; and other circumstances being alike, the loss or waste of metal will also be in the same ratio.

"There are, however, other facts not unworthy of notice. N° 1. pig iron, or richly carbonated metal, when run from an air furnace, will be found in point of quality little better than N° 2. or carbonated iron. This is owing to a quantity of its carbone being destroyed during the fusion. The loss in melting N° 1. iron, therefore, chiefly consists of carbone; and the deficiency of metal ought never, with a clean bottom, to exceed 1 cwt. in 20.

"Carbonated or N° 2. iron also becomes deprived of a considerable portion of its carbonaceous mixture in fusion; and when run from the air furnace is seldom better than N° 3. metal. The loss sustained in melting may be averaged at $7\frac{1}{2}$ per cent.

"N° 3. pig iron is, after melting in an air furnace, found whitish or mottled. It is seldom susceptible of the same nice degree of division as the superior qualities, and loses in fusion a much larger proportion of metal, seldom under 10 per cent. and frequently $12\frac{1}{2}$ or 15.

"The quantity of coals requisite to melt a given quantity of iron is various, as much depends upon the quality and fusibility of the metal. If the furnace goes one heat a day with N° 1. or 2. iron, the quantity of coals will be from 20 to 25 cwt. for a ton of iron. If two or three heats a day, or as many tons of iron are melted at one kindling, the proportion of coals will be nearly weight for weight of the iron melted when the coals are mixed with a fair proportion of small: with strong large splint coals, one ton of good pig iron may be completely reduced with from 12 to 15 cwt. including the previous heating of the furnace *."

* Phil. Mag. xv. 245.

Importance of blowing machinery.

In the reduction and fusion of ores, the improvement of the blowing apparatus, or the machinery contrived for the purpose of forcing a current of air into furnaces, where a high degree of temperature was necessary, has always been an important object of consideration to the manufacturer; and indeed, it appears that the history and improvement of this kind of machinery have progressively advanced, in some cases have exceeded the improvement of other departments of the manufactures of this country.

In smelting some metallic ores, as, for instance, those of lead and tin, the magnitude and powers of blowing machines have been less attended to, because the requisite temperature for that purpose is far inferior to what is necessary for the reduction of the ores of iron. Lead and tin being naturally fusible, and easily volatilized in a temperature beyond a bright red-heat, have hitherto fixed the limits with regard to the size of the furnace, and the quantity of blast. The air furnace is generally employed in the manufacture of copper, excepting in small blast furnaces, in which the precipitated oxide of this metal is received, and they are similar to the furnaces called cupolas, and used at iron founderies.

The lead mill, as it is called, or machine for the reduction of the ores of lead, is of a very simple construction. In the middle of a square building a water wheel is erected, and to the shaft of this wheel, four small wheels of cast iron, about 18 inches in diameter, are attached. Two pairs of bellows placed at equal distances, and on each side of the shaft, are supported on a strong frame of wood. During the revolution of the shaft of the water wheel, the small wheels are also carried round, and alternately depress the end of the lever, which is attached, by means of an iron chain, to an equally balanced beam. When this lever descends, the opposite end of the beam is elevated, and to this end there is attached, by another iron chain, the moveable surface of the bellows. The blast produced in this way is soft, and far inferior, either with regard to quantity or density, to the blast necessary for an iron furnace. The length of the bellows is usually about 10 feet, the breadth across the breech about five or six, and they move at the rate of about 30 strokes a minute.

Which must be of great power in the manufacture of iron.

But in the manufacture of iron, and particularly since the use of pit-coal was introduced, it is absolutely necessary to have a more powerful blowing machinery. This, however, has always been an essential requisite, and has been a constant object in this manufacture; for in proportion to the quantity of air thrown into the furnace, the produce and quantity of metal is increased. In the earlier periods of this manufacture, when the fuel employed was charcoal from wood, the process was more easily managed. Furnaces which were built of small size, and which were then called *bloomeries*, were considered of sufficient capacity to yield profit, if they produced a bloom or two of iron in the day, each bloom amounting to about 90 or 120 lbs. For smaller operations, hand bellows, and what were called fuel blasts, were deemed of sufficient power; but when the refining furnace began to be employed, and the iron manufacture branched out into the making of pig iron, and the refining

Furnace.

refining of it into bar or malleable iron, the advantage and necessity of a powerful blast were immediately seen. The first moving power introduced was that of the water wheel; and this working two or more pairs of leathern bellows, was found to produce effects sufficiently powerful for the purpose.

Progressive improvement of

Machinery constructed in this way, and set in motion by the power of water, continued to be employed for this purpose, till the principles of the steam engine were fully understood, and this powerful machine came into general use. The steam engine, besides many other advantages, could be employed in situations where the want of water prevented furnaces being erected, but otherwise commodious, in being near the necessary materials of ore and fuel. The first substitute for the leathern bellows were cylinders composed of wood, closely jointed, and strongly hooped. These in their turn gave place to cylinders of cast iron, smoothly and accurately bored; and this kind of apparatus being discovered and applied in the manufacture of iron, the blowing machine now assumed a more perfect and more manageable form.

But without attempting to describe any of the blowing machines in our own country, the power and effects of which are familiar to those to whom this knowledge is most interesting, we shall give a short description of an apparatus of this kind, which is set in motion by the pressure of a column of water, and is erected near Namur in the Netherlands. The account of this machine is given by Baillet, inspector of the mines, who observes, that its construction is simple, and not very expensive, and that it may be kept up without requiring much repair. This machine, besides, can be employed to blow several furnaces at once. It does not require any great moving power, and the consumption of water is much less than in the blowing apparatus of leather or wood. In consequence of these advantages, the number of furnaces has been greatly increased since this apparatus was first erected, and the extent of the manufacture has been doubled. This apparatus possesses another superiority over the ordinary blowing machines. The latter, to be put in motion, require a water wheel; but the apparatus which is here alluded to, is set in motion merely by the pressure of a column of water.

blowing machine by the pressure of water.

The following is the description of this blowing machine, as it was first erected at Marche upon the Meuse. It was invented and constructed by Janniens, proprietor of the forges, and it consists of two cylinders of three feet eight inches diameter, and of thirty inches high, placed vertically near each other. One of these cylinders is represented at fig. 16. A piston of wood covered with leather, (fig. 17.) moves in each cylinder, and forces the air through the tubes *o*, *o*, *o*, which are fitted to the upper part of the cylinders, and are conducted to the different furnaces where combustion is to be excited. The base of these tubes is furnished with valves, to prevent the return of the air. The piston is, besides, furnished with two lids or covers, *w*, *w*, (fig. 18. and 19.) which open when it descends, and shut when it rises. The piston is surrounded with a band of leather in the usual way, to make it tight.

Fig. 16.
Fig. 17.
Fig. 18. and 19.

The moving power in this apparatus, is a water wheel erected on the horizontal shaft, *s*. On this shaft are fixed the arms *t*, *t*, projecting from its circumference, which alternately elevate the stalk of the piston. The descent of the piston is regulated by the weight *f*. which acts as a counterpoise; and the spring of wood, *g*, which is balanced when the stalks of the piston are at their lowest descent, serves to retard the velocity, and to prevent any sudden or violent stroke.

Two of these cylinders, erected at one of the forges at Marche, furnish air to two furnaces, which employ charcoal from wood, and one with coke from pit-coal. The stroke of the piston is about 18 inches, and 25 strokes in a minute, and with this length of stroke and velocity, the two pistons produce nearly about 400 cubical feet of air. The consumption of water, having a fall of about 10 feet, is about 80 cubical feet.

The similar cylinders, erected at another furnace at the same place, move with the velocity of 19 strokes per minute. The length of each stroke is about 22 inches, so that it produces about 360 cubical feet of air. For this, with a fall of 10 feet, 75 cubical feet of water are necessary.

In the construction of this blowing machine, no peculiar difficulty occurs. It is not necessary that the cylinders should be accurately turned in the inside. All that is required is, to grind or polish their inner surface with sand stone. It was in this way that the cylinders and apparatus, just described, were prepared.

The piston, which is made of wood, has in the middle of it a mortise, *u*, fig. 17. and 19. to admit the stalk, *p*, which is kept in its place by four bands or straps of iron, *x*, fig. 17.

The band of leather, *z*, is about three lines in thickness, and about five inches broad. It is nailed to the piston, and ought to be raised above the groove or gutter, *v*.

The grooves *y*, *y*, are sunk in the piston, in proportion to the thickness of the leather, and their external diameter should be somewhat smaller than that of the cylinder. The large lids or covers of the piston are of wood, lined with sheep skin; and their hinges, which are made of leather, are fixed with screws to the wood: a bridle of leather limits the extent of the opening.

The small valves, which are fixed at the upper opening of the cylinders, at the end of the tubes for conducting the air, are also of wood, and covered with sheep skin.

The tubes or pipes which conduct the air are made of iron plates, or of tinned iron, and they terminate in pipes of a convenient diameter, and proportioned to the different furnaces. They should also be furnished with keys or cocks, for regulating at pleasure the quantity of the air.

The frame which supports these cylinders is of a very simple construction, as will appear by inspecting fig. 16. It is attached and secured to part of the wall of the building.

All that is necessary to keep this apparatus in order, is with a brush to cover the internal surface of the cylinders with oil once every 10 days.

The following are the dimensions of the principal parts in the old French measure.

The large valves of the piston, 8 inches by 6.
The interval between these valves, 14 inches.
Stalk of the piston, 6 inches square.
The rollers on the axis of the wheel. { Length, 12 inches. Diameter, 36 inches.

Diameter

Diameter of the cylinder, 38 inches.
Height of ditto, 26 do.

Baillet, who has given the above description, proposes a new application of the moving force to this kind of blowing machine; and he observes, that a very important advantage may be derived from these cylinders, since the simple pressure of a column of water may be substituted for the moving power. In fig. 20. the apparatus is so arranged as to shew in what way this effect may be produced.

The stalk *f*, of the cylindrical apparatus *c*, is common to the piston of the small cylinder *d*, in which it can convey the column of water *b c*. When the cock *h* is open, and that at *l* is shut, the pressure of the column must elevate the stalk *f*, and the piston of the blowing cylinder. Then the cock *h* being shut, and that at *l* being open, the water of the cylinder *d* will flow out, and the stalk *f* and the piston of the cylinder will descend. These alternate motions can be easily managed by means of levers, or regulators at *i*, fitted to the stem of the piston, and in the same way as in the steam engine. The openings at *h* and *l* may be regulated according to the velocity which is required in the motion of the piston, and the diameter of the cylinder *d* will be proportioned to the fall of water *b*, *c*, and the volume of air which is wanted.

Explanation of the Figures.

Fig. 16. exhibits a section and elevation of the blowing machine.

a, the wall of the building. *b*, the opening in the wall for the balance beam.

c, one of the two beams which receive the gudgeons on which the balance beam moves. *d*, *e*, the balance beam; *f*, the weight which acts as a counterpoise; *g*, the spring of wood.

h, a brace or strap of leather, which is attached to the curved head of the beam.

i, *k*, *l*, *m*, the frame which supports the cylinders.

n, the blowing cylinder of cast iron.

o, *o*, *o*, tubes for conveying air to the furnace.

p, stalk of the piston.

q, a knee or catch attached to the stalk.

r, the horizontal axis of the water wheel.

s, *s*, arms attached to the axis, with rollers which raise the knee or catch *q*, and the piston.

t, *t*, similar arms and rollers for moving the piston of the second cylinder.

Fig. 17. Section of the piston.

Fig. 18. The piston seen from above.

Fig. 19. View of the under surface of the piston.

Fig. 17. 18. and 19.

p, stalk of the piston.

w, *w*, lids or valves.

v, *v*, groove in the circumference of the piston.

u, mortise to receive the stalk *p*.

x, *x*, straps of iron to support the stalk *p*.

y, *y*, the band of leather surrounding the piston.

Fig. 20. *a*, a reservoir of water; *b*, *c*, a column of water.

d, a cylinder for water.

e, the blowing cylinder.

f, the stalk common to the pistons of the two cylinders, *d* and *e*.

g, the pipe for conducting the air.

h, *l*, cocks for receiving and letting out the water.

i, *i*, the regulators, for the purpose of opening and shutting the cocks.

k, a second blowing cylinder.*

* *Jour. de Mines.*

Three-blast furnace.

The following is a description by Torelli-Narci, of a three-blast furnace, which was constructed in the chemical laboratory of the French school of mines.

"This furnace (says the author) is destined for fusing different mineral substances, in order to ascertain the nature of them; and the experience of six years has shown that it answers the intended purpose. By its means a very intense heat is obtained, and it was employed by C. Clouet for repeating his experiments on the conversion of forged iron into cast steel, which were attended with full success.

"Chemists who have seen this furnace seemed desirous of being better acquainted with the construction of it: the council even transmitted drawings of it to several persons; and what has hitherto prevented a description of it from being given was a desire to ascertain its power by longer use.

"I long ago conceived the idea of a fusing furnace, in which the wind was distributed in three tuyeres placed in its circumference, and at equal distances from each other; but I had no opportunity of realizing this idea till I became attached to the council of mines.

"Nearly seven years ago a plan was in agitation for constructing in the laboratory of the school a fusing furnace capable of producing a very great degree of heat, in order to operate with facility and speed on larger quantities of mineral, and consequently to obtain more precision in the trials which might be made than had been obtained by the small furnaces before employed for docimastic experiments.

"I proposed my ideas: they were approved by the council of mines; and I was ordered to cause the furnace I am about to describe to be constructed. The principal difference between it and those before used for the same purpose is, that in the present one the wind is introduced through three tuyeres, placed at equal distances from each other in its circumference, whereas in common furnaces it enters only by one.

"This furnace is round, both outside and inside, and constructed of very refractory bricks, secured by iron hoops in such a manner that they cannot be displaced. It rests on a square base of strong mason work, raised to a sufficient height above the ground to render it easy to manage.

"The bellows are four feet in length, and the mean breadth of them is about 20 or 21 inches: they are of wood, and the joints are covered with white leather. The upper part consists of five folds and two half folds; the inferior, of two folds and two half folds. They are placed eight or nine feet (K) above a wooden box, the joints of which are covered with leather, and into which the wind

(K) "This height is arbitrary; it depends in part on the manner in which the bellows are disposed, and on the height of the chamber in which the furnace is placed."

wind as it comes from the bellows is conveyed by a copper pipe, three inches in diameter, adjusted to the upper part of the box. The box itself is supported by two iron bars built into the wall. From the lower part of this box descend, in a vertical direction, three pipes of copper, two inches in diameter, bent at right angles about 45 inches below it, to bring them into a horizontal position, and to convey the wind to the furnace, which is about six feet distant. The extremities of these pipes are fitted into three tuyeres of forged iron, fixed at equal distances around the circumference of the furnace: these three pipes are more or less curved or bent, to convey the wind into the furnace by the three apertures made for that purpose.

"About six inches below the box is adjusted, on each of the three tubes, which descend in a vertical direction, a brass cock about three inches of interior diameter: these cocks serve to intercept entirely the communication between the bellows and the furnace; and by opening them all more or less, or each of them separately, any required quantity of wind may be obtained (L).

"These cocks are well fixed to the tubes, and kept in their place by two clips of iron suited to the diameters of the tubes, and forming a kind of three collars, which by means of four screws embrace and confine them: these pieces of iron are themselves made fast to two crutches of iron, which support the box and are fixed to it by screws. The box is kept on the crutches by two straps, which embrace it at each extremity, and are fixed by female screws, which are fitted to screws on the ends of these straps after they have passed through the horizontal part of the two crutches.

To give the proper strength to this furnace, a solid square was constructed of mason-work, about a foot larger on each side than the exterior diameter of the sides of the furnace, which were from 21 to 22 inches from outside to outside. Bricks were placed on the ground in the middle of this erection for the extent of 18 inches, in order to form a bottom, and on this base were placed the sides of the furnace constructed in the manner about to be described.

"I caused to be forged two iron hoops six lines in thickness, from 2 to 2½ inches in breadth, and about 22 inches of exterior diameter; these two circles were fastened together by three bars of iron, the distance of their exterior edge being kept at about nine inches, the height of the bricks: these bars are pierced with holes towards the end rivetted on the circles, and placed at equal distances on their circumference. One of the extremes of each of these three bars is left of a sufficient length to pass beyond the lower circle about an inch, in order to make them enter into three holes formed in the brick-work which forms the bottom of the furnace, and by these means to prevent the furnace from becoming deranged.

"This kind of iron frame was filled with bricks similar to those employed for the bottom of the furnace: they were rubbed one on the other to smooth them, and the corners were a little rounded; so that, being placed upright with their broad sides applied to the iron hoops, the narrow side stood inwards. By these means all these bricks were adjusted in such a manner as to touch each other by their broadest faces, and to form the sides of the furnace, the thickness of which was equal to the breadth of the bricks, and its depth to their length. Three apertures were reserved for the tuyeres which terminate the three tubes that convey the wind, by cutting from as many bricks a portion equal to the thickness of a brick.

"These bricks thus adjusted were taken from the iron frame, and then replaced, putting between them a cement to connect them firmly and to fill up the joints. The dust produced by cutting the bricks was reserved for this purpose; and I desired the workmen to mix with it a small quantity of clay diluted in a great deal of water, in order to make a puddle for daubing over the bricks, and in particular to put between them no more than was necessary for filling the joints and the small space left between their faces in consequence of any inequality left in dressing them.

"The furnace thus constructed was then placed on its base, a stratum of the same mortar employed for filling up the joinings of the bricks being first interposed. The extremities of the three iron bars projecting beyond the lower circle were placed in the holes left in the base to receive them. The body of the furnace encircled with iron, both by its weight and the gentle blows given to the iron hoops above the bars which connected them, expelled the excess of the mortar, and caused a part of it to enter and unite with that which filled up the joints of the brick work of the circumference, which rendered it immoveable.

"The bellows is secured as usual by crutches of iron and supporters fixed in the wall and to the floor: the handle is disposed in such a manner, that the rope which makes it act may be pulled by the same person who manages the fire of the furnace, which in certain cases is necessary.

"The tuyeres of forged iron, which receive the ends of the copper tubes, are secured in their proper apertures in the circumference of the furnace by pieces of brick and mortar similar to that employed for filling up the joints; and the ends of the copper pipes introduced into these tuyeres are luted with the same mortar, a little thickened with brick dust.

"The apertures of these tuyeres towards the interior of the furnace is only nine lines in diameter; on which account,

(L) "Care must be taken, when the action of the bellows ceases, to shut the cocks, especially when coals are used in the furnace; for the hydrogen disengaged from that mineral substance ascends into the box, and when the bellows are again made to act, may inflame and cause a violent explosion, or even burst the bellows. This accident once took place in the furnace here described: the box burst with a loud noise on the first stroke of the bellows, the gas which filled them having suddenly inflamed; but by good fortune no person was hurt. The same thing happened at the house of C. Gorlier, locksmith of Paris; one of his bellows burst with a horrid explosion at the moment when they were put in motion."

Furnace. account, as the volume of air furnished by the bellows cannot pass so quick as it is produced, it becomes condensed in the box placed above the cocks. By these means a very uniform blast is obtained, which can also be regulated by opening more or fewer of the cocks.

"During more than six years, since this furnace was constructed, it has suffered no derangement: it is not even cracked. It is however worn in the inside by the violence of the heat it has experienced, which has increased its diameter about two inches. The parts round the three tuyeres have also got hollowed, so that it has need of being repaired. It is intended to make it deeper, and to have a kind of moveable muffs or linings made of fire clay, in order that its diameter may be reduced at pleasure: it is meant also to construct it in such a manner, as to deposit the rest or support for the crucible, not on the bottom of the furnace, but on bars of forged iron placed at the distance of some inches from that bottom, so as to leave below them a vacuity in which the blast of the bellows may be diffused, and from which it may rise, passing between the bars to traverse the mass of charcoal which surrounds the crucible. The blast will then produce a more uniform fire, and the flame can no longer be directed against the sides of the crucibles; so that the risk of their breaking by sudden inequalities in the heat will be much less.

"This alteration is going to be immediately carried into execution, and the method proposed for doing it is as follows:

"A round frame will be made of forged iron, in which bricks will be placed in the same manner as above described. In the lower part of the furnace an aperture will be reserved for raking out the ashes, which will be closed by means of a door of baked earth carefully luted with clay. Some inches above the bottom of the furnace will be placed a grate of forged iron, and between this grate and the bottom of the furnace the tuyeres will terminate, and the blast be introduced. Muffs or linings of very refractory earth will then be introduced, so as to descend to this grate. There will be two of them, one within the other, and both within the body of the furnace. At the lower part these muffs will be furnished with a rim, projecting outward so as to leave between the body of the furnace and the muffs, a vacuity, which will be luted at the bottom with clay, and which will be filled with pounded glass, or any other substance a bad conductor for heat.

The interior muff, or both of them, may be removed at pleasure to obtain a furnace of greater or less capacity according to the operations to be performed. It is proposed to make the muffs wider at the top than at the bottom.

Explanation of the Figures.

Plate CCXXV. fig. 21. "Fig. 21. Plan of the bellows and of the furnace. AB, the bellows made of wood, the folds of which are also of wood covered with leather on the joints. CD, the handle which serves for moving the bellows. E, a copper tube which conveys the wind of the bellows into the box FG, in which it is condensed. FG, a box of wood serving as a reservoir for the wind condensed by the bellows. HI, KL, MN, three pipes adapted to the box FG, and which convey the wind into the inside of the furnace by three tuyeres, I, L, N. OP, mason work to support the horizontal pipes. Q, the furnace properly so called, the former of which is circular, and which is placed on the square mason work R, S, T, U.

"Fig. 22. Elevation of the furnace, the pipes which convey the blast, the cocks, the condensing box, and the bellows. AB, the bellows mounted in their place, and supported by the iron-work necessary for securing it, which is fixed in the wall and to the floor. CD, the handle which serves for moving the bellows. E, the copper pipe which conveys the blast of the bellows to the box FG in which it is condensed. At G is a hole shut by a large cork stopper, which can be opened at pleasure. This box is supported by two crutches of iron *f*, *g*, and *h*, *i*, built into the wall, and on which it is fixed by two iron stirrups *l*, *m*. Fig. 22.

"Fig. 23. One of the crutches and its stirrup are seen represented sidewise at *f*, *g*, *l*; the extremities, *n*, *o*, are built into the wall, and the two ends, *p*, *q*, of the iron piece which keeps the box on the horizontal traverse of the crutch, are tapped, and receive screws which make them fast to the crutch *f*, *g*. HI, KL, MN, are three pipes which convey the wind into the interior of the furnace. Q, R, S, T, U, mason work on which is placed the furnace Q, and which serves it as a bottom. OP, masonry which serves to support the three pipes that convey the wind to the furnace. XYZ, fig. 22. are the three cocks fixed to the three pipes which proceed from the box to convey the wind to the furnace. Fig. 23.

"In fig. 24. the dimensions of which are double those of fig. 22. may be seen the details of one of these cocks. Fig. 24.

"At *r*, *s*, *t*, the body of the cock is seen in front; the stopper being taken out shows at *r* and at *t* the two holes which receive the tubes that communicate either with the box or with the tuyeres. *u* Exhibits the body of the cock seen on one side; *v* the key with its aperture *x*, and its head *y*. This key, turned round more or less in its socket, serves to give more or less wind. 1, 2, 3, Iron clips which secure the cocks at the distance they ought to be from each other, and connect them at the same time to the iron crutches which support the air-box.

"Fig. 25. a plan of these two clips. They are bent at the places marked 1, 2, 3, to embrace the body of the three cocks, and secure them in such a manner that they cannot be deranged when they are opened or shut. Fig. 25.

"Fig. 26. and 27. represent the plan and section of the changes and additions proposed to be made when the furnace is re-constructed. At I, L, and N, are seen the extremities of the three pipes that enter the forged iron tuyeres, and convey the wind to the interior of the furnace. *a*, *b*, and *c*, indicate the thickness at the upper part of each of the muffs and of the body of the furnace, between which there are two vacuities filled with pounded glass or some other bad conductor of heat. *d*, the grate on which are deposited the rests of baked earth destined to receive the crucibles. *e*, the crucible, luted and attached with clay to a rest of baked earth (M)." Fig. 26. and 27.

Mr

(M) "The advantage arising in large founderies from the application of two or three tuyeres instead of one, is well known; but I do not believe that such an arrangement was ever adopted in small furnaces.

Furnace.

Mr Collier, in a paper communicated to the Manchester Philosophical Society, has delivered some important observations on iron and steel, with a more correct account of the process for the manufacture of the latter than has hitherto been given. To this account he has added the description of a furnace for the conversion of iron into steel. As his observations and reasonings are extremely valuable, we shall lay the whole before our readers in his own words.

Accounts of the process for making iron and steel, imperfect.

" After examining (says (Mr Collier) the works of different authors who have written on the subject of making iron and steel, I am persuaded that the accounts given by them of the necessary processes and operations are extremely imperfect. Chemists have examined and described the various compound minerals containing iron with great accuracy, but have been less attentive to their reduction. This observation more particularly applies to steel, of the making of which I have not seen any correct account.

" It is singular to observe, how very imperfectly the cementation of iron has been described by men of great eminence in the science of chemistry. Citizen Fourcroy states the length of time necessary for the cementation of iron to be about twelve hours; but it is difficult to discover whether he alludes to cast or to bar steel: for he says, that short bars of iron are to be put into an earthen box with a cement, and closed up. Now steel is made from bars of iron of the usual length and thickness: but cast steel is made according to the process described by Citizen Fourcroy, with this essential difference; the operation is begun upon bar steel and not bar iron.

" Mr Nicholson is equally unfortunate in the account given in his Chemical Dictionary. He says, that the usual time required for the cementation of iron is from six to ten hours, and cautions us against continuing the cementation too long; whereas the operation, from the beginning to the end, requires sixteen days at least. In other parts of the operation he is equally defective, confounding the making of bar with that of cast steel, and not fully describing either. In speaking of the uses of steel, or rather of what constitutes its superiority, Mr Nicholson is also deficient. He observes, that 'its most useful and advantageous property is that of becoming extremely hard when plunged into water.' He has here forgotten every thing respecting the temper and tempering of steel instruments, of which, however, he takes some notice in the same page. 'Plunging into water' requires a little explanation: for if very hot steel be immersed in cold water without great caution, it will crack, nay, sometimes break to pieces. It is, however, necessary to be done, in order to prevent the steel from growing soft, and returning to the state of malleable iron; for, were it permitted to cool in the open air, the carbone which it holds in combination would be dissipated (N).

Process at Sheffield.

" I shall, at present, confine my remarks to the operation performed on iron in Sheffield and its neighbourhood: from whence various communications have been transmitted to me by resident friends, and where I have myself seen the operations repeatedly performed.

For the reduction of the ore,

" The iron made in that part of Yorkshire is procured from ores found in the neighbourhood, which are of the argillaceous kind, but intermixed with a large proportion of foreign matter. These, however, are frequently combined with richer ores from Cumberland and other places. The ore is first roasted with cinders for three days in the open air, in order to expel the sulphureous or arsenical parts, and afterwards taken to the furnaces: some of which are constructed so that their internal cavity has the form of two four-sided pyramids joined base to base; but those most commonly used are of a conical form, from 40 to 50 feet high. The furnace is charged at the top with equal parts of coal-cinder and lime-stone. The lime-stone acts as a flux, at the same time that it supplies a sufficient quantity of earthy matter to be converted into scoriæ, which are necessary to defend the reduced matter from calcination, when it comes near the lower part of the furnace. The fire is lighted at the bottom; and the heat is excited by means of two pair of large bellows blowing alternately. The quantity of air generally thrown into the furnace is from a thousand to twelve hundred square feet in a minute. The air passes through a pipe, the diameter of which is from two inches and a quarter, to two and three quarters, wide. The compression of air which is necessary is equal to a column of water four feet and a half high. The ore melts as it passes through the fire and is collected at the bottom, where it is maintained in a liquid state. The slag, which falls down with the fused metal, is let off, by means of an opening in the side of the furnace, at the discretion of the workmen.

" When a sufficient quantity of regulus, or imperfectly reduced metal, is accumulated at the bottom of the furnace (which usually happens every eight hours), it is let off into moulds; to form it for the purposes intended, such as cannon or pig iron.

" Crude iron is distinguished into white, black, and gray. The white is the least reduced, and more brittle than the other two. The black is that with which a large quantity of fuel has been used; and the gray is that which has been reduced with a sufficient quantity of fuel, of which it contains a part in solution.

and refining iron.

" The operation of refining crude iron consists in burning the combustible matter which it holds in solution; at the same time that the remaining iron is more perfectly reduced, and acquires a fibrous texture. For this purpose, the pigs of cast iron are taken to the forge; where they are first put into what is called the refinery: which is an open charcoal fire,

" At Treibach, in Carinthia, C. Le Febre, and Hassenfratz member of the council and inspector of mines, saw about twenty years ago, a large furnace with two tuyeres; drawings of which they brought to France, and which they represented in the third plate of *l' Art de fabriquer les Canons*, by Monge: two pairs of bellows supply wind through two opposite tuyeres, and since that arrangement the daily product of metal has been double."

(N) " It is the opinion of some metallurgists, that a partial abstraction of oxygen takes place, by plunging hot metal into cold water."

Furnace. fire, urged by a pair of bellows, worked by water or a steam engine; but the compression of air, in the refinery, ought to be less than that in the blast furnace. After the metal is melted, it is let out of the fire by the workmen, to discharge the scoriæ; and then returned and subjected to the blast as before. This operation is sometimes repeated two or three times before any appearance of malleability (or what the workmen call coming into nature) takes place; this they know by the metal's first assuming a granular appearance, the particles appearing to repel each other, or at least to have no signs of attraction. Soon afterwards they begin to adhere, the attraction increases very rapidly, and it is with great difficulty that the whole is prevented from running into one mass, which it is desirable to avoid, it being more convenient to stamp small pieces into thin cakes: this is done by putting the iron immediately under the forge hammer, and beating it into pieces about an inch thick, which easily break from the rest during the operation. These small pieces are then collected and piled upon circular stones, which are an inch thick, nine inches in diameter, and about ten inches high. They are afterwards put into a furnace, in which the fire is reverberated upon them until they are in a semi-fluid state. The workmen then take one out of the furnace, and draw it into a bar under the hammer; which being finished, they apply the bar to another of the piles of semi-fluid metal, to which it quickly cements, is taken again to the hammer, the bar first drawn serving as a handle, and drawn down as before. The imperfections in the bars are remedied by putting them into another fire called the chafery, and again subjecting them to the action of the forge hammer.

"The above method is now most in use, and is called flourishing; but the iron made by this process is in no respect superior to that which I am going to describe. It is, however, not so expensive, and requires less labour.

"The process for refining crude iron, which was most common previously to the introduction of flourishing, is as follows.

"The pigs of cast iron are put into the refinery, as above, where they remain until they have acquired a consistence resembling paste, which happens in about two hours and a half. The iron is then taken out of the refinery and laid upon a cast iron plate on the floor, and beaten by the workmen with hand hammers to knock off the cinders and other extraneous matters which adhere to the metal. It is afterwards taken to the forge hammer and beaten, first gently, till it has obtained a little tenacity; then the middle part of the piece is drawn into a bar, about half an inch thick, three inches broad, and four feet long; leaving at each end a thick square lump of imperfect iron. In this form it is called ancony. It is now taken to the fire called the chafery, made of common coal; after which the two ends are drawn out into the form of the middle, and the operation is finished.

"There is also a third method of rendering crude iron malleable, which, I think, promises to be abundantly more advantageous than either of the two former, as it will dispense both with the refinery and chafery: and nothing more will be necessary than a reverberating furnace, and a furnace to give the metal a malleable heat, about the middle of the operation. The large forge hammer will also fall into disrepute, but in its place must be substituted metal rollers of different capacities, which, like the forge hammer, must be worked either by a water wheel, or a steam engine. An improved process.

"It is by the operation of the forge hammer or metal rollers, that the iron is deprived of the remaining portion of impurity, and acquires a fibrous texture.

"The iron made by the three foregoing processes is equally valuable, for by any of them the metal is rendered pure; but after those different operations are finished, it is the opinion of many of the most judicious workers in iron, that laying it in a damp place, for some time, improves its quality; and to this alone, some attribute the superiority of foreign iron, more time elapsing between making and using the metal. To the latter part of this opinion I can by no means accede, as it is well known that the Swedish (o) ores contain much less heterogeneous matters than ours, and are generally much richer, as they usually yield about 70 per quintal of pure iron, whereas the average of ours is not more than 30 or 40 (p): add to this, that the Swedish ores are smelted in wood fires, which gives the iron an additional superiority.

"Iron instruments are case-hardened by heating them in a cinder or charcoal fire; but if the first be used, a quantity of old leather, or bones, must be burnt in the fire to supply the metal with carbone. The fire must be urged by a pair of bellows to a sufficient degree of heat; and the whole operation is usually completed in an hour.

"The process for case-hardening iron, is in fact the same as for converting iron into steel, but not continued so long, as the surface only of the article is to be impregnated with carbone.

"Some attempts have been made to give cast iron, by case-hardening, the texture and ductility of steel, but they have not been very successful. Table and penknife blades have been made of it, and, when ground, have had a pretty good appearance; but the edges are not firm, and they soon lose their polish. Common table knives are frequently made of this metal.

"The cementation of iron converts it into steel:—a substance intermediate between crude and malleable iron.

"The furnaces for making steel are conical buildings; about the middle of which are two troughs of brick or fire stone, which will hold about four tons of iron in the bar. At the bottom is a long grate for fire. Furnace for making steel.

"A layer of charcoal dust is put upon the bottom of the

(o) "Steel is commonly made of Swedish iron."

(p) "The iron made from the ore found in the neighbourhood of Sheffield, contains a great deal of phosphate of iron, or siderite, which renders the metal brittle when cold."

Furnace. the trough; and, upon that, a layer of bar iron, and so on alternately until the trough is full. It is then covered over with clay to keep out the air; which, if admitted, would effectually prevent the cementation. When the fire is put into the grate, the heat passes round by means of flues, made at intervals, by the sides of the trough. The fire is continued until the conversion is complete, which generally happens in about eight or ten days. There is a hole in the side by which the workmen draw out a bar occasionally, to see how far the transmutation has proceeded. This they determine by the blisters upon the surface of the bars. If they be not sufficiently changed, the hole is again closed carefully to exclude the air; but if, on the contrary, the change be complete, the fire is extinguished, and the steel is left to cool for about eight days more, when the process for making blistered steel is finished.

Blistered steel.

"For small wires, the bars are drawn under the tilt hammer, to about half an inch broad and three-sixteenths of an inch thick.

Tilted steel. "The change wrought on blistered steel by the tilt hammer, is nearly similar to that effected on iron from the refinery by the forge hammer. It is made of a more firm texture, and drawn into convenient forms for use.

German steel. "German steel is made by breaking the bars of blistered steel into small pieces, and then putting a number of them into a furnace; after which they are welded together and drawn to about 18 inches long; then doubled and welded again, and finally drawn to the size and shape required for use. This is also called shear steel, and is superior in quality to the common tilted steel.

Cast steel. "Cast steel is also made from the common blistered steel. The bars are broken and put into large crucibles with a flux. The crucible is then closed up with a lid of the same ware, and placed in a wind furnace. By the introduction of a greater or smaller quantity of flux, the metal is made harder or softer. When the fusion is complete, the metal is cast into ingots, and then called ingot steel; and that which afterwards undergoes the operation of tilting, is called tilted cast steel.

"The cast steel is the most valuable, as its texture is the most compact and it admits of the finest polish.

"Sir T. Frankland has communicated a process, in the Transactions of the Royal Society, for welding cast steel, and malleable iron together; which, he says, is done, by giving the iron a malleable, and the steel a white heat; but, from the experiments which have been made at my request, it appears, that it is only soft cast steel, little better than common steel, that will weld to iron: pure steel will not; for, at the heat described by Sir T. the best cast steel either melts or will not bear the hammer.

"It may here be observed, as was mentioned before, that steel is an intermediate state between crude and malleable iron, except in the circumstance of its reduction being complete; for, according to the experiments of Reanmur and Bergman, steel contains more hydrogen gas than cast iron, but less than malleable iron;—less plumbago than the first, but more than the latter;—an equal portion of manganese with each;—less siliceous earth than either—more iron than the first, but less than the second. Its fusibility is likewise intermediate, between the bar iron and the crude. When steel has been gradually cooled from a state of ignition, it is malleable and soft, like bar iron: but when ignited and plunged into cold water, it has the hardness and brittleness of iron.

"From the foregoing facts, we are justified in drawing the same conclusions with Reaumur and Bergman, but which have been more perfectly explained by Vandermonde, Berthollet, and Monge, that crude iron is a regulus, the reduction of which is not complete; and which consequently will differ according as it approaches more or less to the metallic state. Forged iron, when previously well refined, is the purest metal; for it is then the most malleable and the most ductile, its power of welding is the greatest, and it acquires the magnetic quality soonest. Steel consists of iron perfectly reduced and combined with charcoal; and the various differences in blistered steel, made of the same metal, consists of the greater or less proportion of charcoal imbibed.

"Iron gains by being converted into steel, about the hundred and eightieth part of its weight.

"In order to harden steel, it must be put into a clean charcoal, coal, or cinder fire, blown to a sufficient degree of heat by bellows. The workmen say, that neither iron nor steel will harden properly without a blast. When the fire is sufficiently hot, the instrument intended to be hardened must be put in, and a gradual blast from the bellows continued until the metal has acquired a regular red heat; it is then to be carefully quenched in cold water. If the steel be too hot when immersed in water, the grain will be of a rough and coarse texture; but if of a proper degree of heat, it will be perfectly fine. Saws and some other articles are quenched in oil. Harden steel.

"Steel is tempered by again subjecting it to the action of the fire. The instrument to be tempered we will suppose to be a razor made of cast steel. First rub it upon a grit stone until it is bright; then put the back upon the fire, and in a short time the edge will become of a light straw colour, whilst the back is blue. The straw colour denotes a proper temper either for a razor, graver, or penknife. Spring knives require a dark brown; scissars, a light brown, or straw colour; forks or table knives, a blue. The blue colour marks the proper temper for swords, watch-springs, or any thing requiring elasticity. The springs for penknives are covered over with oil before they are exposed to the fire, to temper. Temper it.

Explanation of the Figures.

"Fig. 28. is a plan of the furnace, and fig. 29. is a section of it taken at the line AB. The plan is taken at the line CD. The same parts of the furnace are marked with the same letters in the plan and in the section. EE are the pots or troughs into which the bars of iron are laid to be converted. F is the fireplace; P, the fire bars; and R, the ashpit. GG, &c. are the flues. HH is an arch, the inside of the bottom of which corresponds with the line IIII, fig. 28. and the top of it is made in the form of a dome, having a hole in the centre as K, fig. 29. LD, &c. are six chimneys. MM is a dome, similar to that of a glass-house, covering the whole. At N there is an arched opening, at which the materials are taken in and out of the furnace, Fig. 28 and 29.

nace, and which is closely built up when the furnace is charged. At OO there are holes in each pot, through which the ends of three or four of the bars are made to project quite out of the furnace. These are for the purpose of being drawn out occasionally to see if the iron be sufficiently converted.

"The pots are made of fire tiles, or fire stone. The bottoms of them are made of two courses, each course being about the thickness of the single course which forms the outsides of the pots. The insides of the pots are of one course, about double the thickness of the outside. The partitions of the flues are made of fire brick, which are of different thicknesses, as represented in the plan, and by dotted lines in the bottom of the pots. These are for supporting the sides and bottoms of the pots, and for directing the flame equally round them. The great object is to communicate to the whole an equal degree of heat in every part. The fuel is put in at each end of the fire-place, and the fire is made the whole length of the pots, and kept up as equally as possible."

Improved process of cupellation.

In a memoir published by Du Hamel, the inconvenience and expence which attend the process commonly in use, for refining lead or separating the silver from this metal, are pointed out, and a more economical process is proposed. This process, which is known by the name of *cupellation*, is performed in a vessel called the *cupel*, which is made of the ashes of the bones of animals, or of vegetables, after separating, by means of water, the saline parts which adhere to them. But the difficulty and expence of obtaining a sufficient quantity of these materials, led him to contrive something else as a substitute, which might be less costly and more easily obtained.

For the purpose of performing the process in the way here recommended, it is not necessary to make any alteration in the general construction of the furnace. All that is required is, to have a sufficient number of canals or openings towards its base, to allow the escape of the moisture. These canals are covered with a bed of scoria, on which is raised a pavement formed of the most porous bricks, and about a brick in thickness. On this floor or area, which should be a little concave, in the same way as the ordinary cupels are formed when they are made of ashes, is placed a quantity of casting or moulding sand, slightly moistened; and if the sand has not a sufficient quantity of earth, some clay is added, to give it consistence, and the whole is carefully mixed together. This sand is beaten together, and a concave vessel is made of it, of an equal thickness in all its parts. When the bason has been uniformly beaten, it will be proper to sift over its whole surface a small quantity of wood ashes, well washed with water, and these are also beaten down with a pestle.

The cupel being thus prepared, the head of the furnace is put on, and a moderate fire is kindled and kept up for some hours, to carry off part of the moisture of the sand. The remainder is dissipated without inconvenience, by means of the canals, during the process. After it has been sufficiently dried, the head of the furnace is again taken off, and allowed to cool a little. A quantity of straw or hay is put upon the bason or cupel, to prevent any injury from the weight of the bars of lead on the sand. To avoid this still more, it is recommended to have the lead to be purified cast into the form of hemispheres, in place of bars.

A sufficient quantity of lead being introduced into the furnace, the head is luted on with baked clay, and the fire is applied in the usual way. As soon as the lead is completely fused, the bason appears covered with the burnt straw: this is removed by means of an iron instrument, and this operation is repeated several times. When the lead begins to grow red, the action of the bellows commences, at first softly, and the blast is so directed that it may strike the centre of the cupel. To effect this more completely, a small round plate of iron is attached to the extremity and upper part of the pipe by means of a hinge, so that at each blast it is half raised, and the current of air is directed to the surface of the fused metal.

After the whole of the scum that rises has been removed, and the lead is covered with a stratum of litharge, a small gutter is made by means of a hook for the purpose, in the sand of the cupel. This is gradually and cautiously hollowed, till it is on a level with the surface of the bath, and then the litharge driven by the blast towards the anterior part of the furnace, will flow this way, and spread itself on the floor in the usual way. When the operator perceives that the litharge has been removed, he stops up the gutter with moistened ashes, till another quantity of litharge appears on the surface. He then re-opens the gutter, which is now made deeper in proportion to the diminution of the fused metal, but at the same time taking care that no part of the lead escapes, especially towards the end of the process, because then a considerable portion of silver would be carried off.

In this way the process is conducted till the separation of the silver begins to take place, observing at the same time to increase the heat as the quantity of fused metal diminishes, because then the silver is collected together; and since it is much more difficult to keep it in fusion than the small portion of lead which remains combined with it, the separation would be very imperfect, without the application of a sufficient temperature. Instead of having only one-twentieth of lead, which is the usual proportion in the common process, the quantity would be much greater, and this would render the second operation, the refining of the silver, much more difficult.

Du Hamel observes, that a cupel of sand, well made, will answer for the repetition of the process several times, without renewing it at the end of each operation, as is the case with those of ashes. The only precaution to be observed is, to remove the kind of varnish of oxyde of lead which remains on the sides of the gutter by which the litharge flowed out, that the new sand with which it is to be filled up may combine easily with the old.

The length of time which the reverberatory furnace may be employed in smelting the ores of lead, and even in reducing litharge, is a proof that the oxyde of lead acts only on the surface of the cupel, and penetrates a very small thickness. After the process has been several times repeated, this crust is removed, and it is fused for the purpose of obtaining the lead. This process will be as easy as the reduction of the metal contained in the ashes of the ordinary cupels, and in much smaller quantity.

Furnace. quantity. By the new method, therefore, a greater proportion of litharge is obtained; and it may be added, that the sand absorbing a smaller quantity of oxyde of lead, it will contain also a smaller proportion of silver; for it is well known that the lead which is reduced from the ashes, contains always much more than that which is produced from the reduction of litharge.

In place of sand, argillaceous earth may be employed in the construction of cupels; but it is necessary that this earth be well beaten together, and that this process should be several times repeated, for several days, without which the clay would be apt to crack, and the melted lead would flow into the crevices; an inconvenience which does not arise from the use of sand, even although it should be mixed with a little earth. And besides, it is to be observed, that the cupel constructed of this substance, becomes too hard to allow a gutter to be easily made for the passage of the litharge. In this case, it would be necessary that the place by which the oxyde is to flow out, be made up of sand, or of ashes.

In the formation of the bason or cupel, which is here proposed, it seems to be advantageous to employ two kinds of sand, the one fine, like that which is used by the founders, the other coarser, and free from earth. It is of the latter, the coarse kind, that the first stratum is formed; and this, after being made of sufficient thickness, is well beaten with pestles for the purpose; on this the fine sand is to be placed, containing a proper proportion of earth, and it is to be beaten together in the same way. Both the coarse and the fine sand are to be moistened a little, that they may adhere together, and afterwards acquire a sufficient degree of solidity under the pestles. The sand of the inferior layer being coarser than the other, will absorb the moisture from it as it evaporates, and will allow it to pass off easily, by means of the canals or openings which are left for that purpose. This stratum, too, is to remain in its place, when the fine sand of the cupel is removed, and that the surface of the stratum of coarse sand may not be disturbed when the other is removed, a thin layer of ashes may be thrown upon it, and beaten down, before the other stratum is laid on *.

* Mem. de l'Inst. iii. 306.

The French school of mines appointed a commission, composed of Hassenfratz, Brochant, and Miché, to consider the best form for the construction of a furnace for burning lime-stone, or plaster of Paris. After considering different forms of furnaces, and reasoning on their effects, they propose in their report to adopt the following, which is represented in fig. 30. and 31.

Fig. 30. Fig. 30. is a plan of the furnace proposed.

D, the fire-place. E, E, openings for taking out the substances which are converted into lime or plaster.

P, half of the plan taken at the height of the line AK of fig. 31.

Q, half of the plan taken at the height of the line XY of fig. 31

Fig. 31. Fig. 31. exhibits a section of the same furnace.

B, C, are places which remain empty after the introduction of the substances to be exposed to heat.

B, D, the fires.

E, the opening for the extraction of the substances after they are converted into lime or plaster.

O, the throat or vent.

a, *b*, openings for regulating the heat.

We shall now conclude this article with a short account of the construction and management of furnaces for chemical purposes.

Chemical furnace. The following is a description of an essay or cupelling furnace. 1. A hollow, quadrangular prism, 11 inches broad and nine inches high, is constructed with iron plates, and it ends at top in a hollow quadrangular pyramid, seven inches high; the latter terminating in an opening seven inches square. The prism is closed at bottom with another iron plate, which serves as a bottom.

2 Near the bottom a door three inches high and five inches broad, is opened. This leads to the ash hole.

3. Above this door, and six inches from the basis, another door is opened, of the figure of a segment of a circle, four inches broad at the bottom, and three inches and a half big in the middle.

4. Three iron plates are then to be fastened to the fore-part of the furnace, the first of them should be 11 inches long, half an inch high, and so fastened with three or four rivets, that its lower edge may rest against the bottom of the furnace. Between this plate and the side of the furnace a space must be left, so wide that the sliders of the lower door, which are made of a thicker iron plate, may move easily in the groove. The second iron plate, which is 11 inches long, and three inches high, is fastened parallel to the first, in the space between the two doors. Both the upper and lower edges of this plate form grooves with the side of the furnace, for receiving the sliders which shut the doors. The third plate, of the same dimensions with the first, is rivetted close above the upper door, and forms a groove for receiving the edge of the sliders which move that door.

5. For the purpose of closing the doors, two sliders of iron-plates must be adapted to each of them. These sliders are moved in the grooves. The two sliders belonging to the upper door have each a hole near the top; in the one there is a small hole $\frac{1}{4}$ of an inch broad, $\frac{1}{2}$ inch long; and the other a semicircular opening one inch high and two broad. To each slider there is a handle attached, to lay hold of it when it is moved.

6. Five round holes, an inch diameter, are bored in the furnace, two in the back part, and two in the fore part, five inches from the bottom; but $3\frac{1}{2}$ inches from each side of the furnace. The fifth hole is at the height of an inch above the upper edge of the upper door.

7. The inside of the furnace must be armed with iron hooks, about three inches from each other, and projecting $\frac{1}{2}$ inch. The use of these hooks is to secure the lute with which the furnace is to be lined.

8. A moveable, hollow, quadrangular pyramid, also of iron, and 3 inches high, is to be fitted to the upper opening of the furnace, 7 inches broad, and ending above in a hollow tube, three inches in diameter, about 2 inches high, nearly cylindrical, but converging a little at the top. This tube serves to support a funnel for conveying the smoke into the chimney. This cover has two handles to lay hold of it. To secure the cover on the furnace, an iron plate is rivetted to the right and left of its upper edge, and turned down towards the inside, so that a furrow may be made, open before

Furnace. fore and behind, for receiving the lateral edges of the cover.

9. A square ledge, made of thick iron plate, is fixed at the top of the upper edge of the lower door, for supporting the grate and the lute, and, that it may be easily introduced into the cavity of the furnace, it should be of two pieces.

10. Iron bars are then to be fixed in the inside of the furnace, for supporting the fuel. These must be equal in length with the diameter of the furnace, about $\frac{1}{2}$ inch thick, and $\frac{3}{4}$ inch distant from each other. They are supported at their extremities by a square iron ledge.

11. To prevent the dissipation of the heat, and the destruction of the iron, by being repeatedly made red hot, the inside of the furnace must be lined with lute, about a finger's breadth, or rather more, in thickness.

Coating for furnaces. For luting furnaces, Dr Black recommended a simple mixture of sand and clay. The proportions for resisting the violence of fire are four parts of sand to one of clay; but when designed for the lining of furnaces, he uses six or seven of sand to one of clay, the more effectually to prevent the contraction of the latter; for it is known from experiments, that clay, when exposed to a strong heat, contracts the more in proportion to its purity. The sand settles into less bulk when wet, and does not contract by heat, which it also resists as well as the clay itself.

Besides this outside lining next the fire, Dr Black uses another to be laid on next the iron of the furnace; and this consists of clay mixed with a large proportion of charcoal dust. It is more fit for containing the heat, and is put next to the iron, to the thickness of an inch and a half. That it may be pretty dry when first put in, he takes three parts by weight of the charcoal dust, and one of the common clay, which must be mixed together when in dry powder, otherwise it is very difficult to mix them perfectly. As much water is added as will form the matter into balls; and these are beaten very firm and compact by means of a hammer upon the inside of the furnace. The other lute is then spread over it to the thickness of about half an inch, and this is also beaten solid by hammering; after which it is allowed to dry slowly, that all cracks and fissures may be avoided; and after the body of the furnace is thus lined, the vent is screwed on and lined in the same manner. It must then be allowed to dry for a long time; after which a fire may be kindled, and the furnace gradually heated for a day or two. The fire is then to be raised to the greatest intensity; and thus the luting acquires a hardness equal to that of free-stone, and is afterwards as lasting as any part of the furnace.

Mode of operating with the furnace. To perform an operation in this furnace, two iron bars an inch thick, and of sufficient length to project a little beyond the holes of the furnace, are passed through four lower holes, which are placed before and behind, directly opposite to each other. These bars support the muffle, which is introduced through the upper opening of the furnace, and placed upon the bars, in such a way that the open side of it may be near the inner border of the upper door. The fuel is introduced through the top of the furnace, and the best fuel is charcoal made of hard wood. It should be reduced to small pieces, that they may readily fall between the muffle and the sides of the furnace. The muffle is to be covered with fuel, to the height of several inches. The pieces of charcoal should not be too small, because they may fall immediately through the interstices of the grate, or be too rapidly consumed, and thus increasing the quantity of ashes, obstruct the current of air.

Management of the fire. As the management of the fire is of great importance, for the success of operations in the furnace, the following directions may be attended to. To increase the heat to the utmost, the door of the ash-hole may be left open; the sliders of the upper door drawn towards each other, so as to touch in the middle, and the cover and funnel adapted to its tube, placed on the top of the furnace. The heat is still farther increased by putting red burning coals into the open upper door. By shutting the upper door with the slider, which has a narrow oblong hole in it, the heat is diminished, and it is still farther diminished by shutting the door with the other slider, having the semicircular hole. The heat is also diminished by removing the funnel at the top of the cover; and the heat is less by partially or totally shutting the door of the ash-hole, because then the current of air necessary to excite combustion is obstructed.

The heat of the furnace is also increased in proportion to the diminished size of the muffle. The heat is stronger too, according as the muffle has more and larger segments cut out of it, as the sides of it are thinner, and as the number of vessels placed in the hinder part of it is increased; and the contrary. It may be here observed, that when many of the conditions necessary to produce strong heat are wanting, the operator, with all his sagacity, will scarcely be able to excite combustion in such a degree in common assay furnaces as to succeed well in his operations; and even when he employs bellows, and introduces coals by the upper door. The grate, therefore, ought to be placed nearly three inches below the muffle, that the air rushing through the ash-hole, may not cool its bottom, and that the smaller coals, almost already consumed, and the ashes, may more easily fall through the interstices of the grate; larger coals, fit for keeping up the requisite degree of heat, must be used. The funnel is added, that the blowing of the fire being increased by means of it as much as possible, may be brought to the degree that is wanted; for the fire may be at any time diminished, but without the assistance of proper apparatus, it cannot always be increased at pleasure.

Explanation of Fig. 32, 33, and 34.

Fig. 32. Fig. 32. *a, a, b, b*, body of the assay furnace.

b b, c c, top of the same.

d, opening at the top of the furnace.

e, door leading to the ash hole.

f, upper door.

gg, h h, i i, the iron plates rivetted on the furnace, which form the grooves in which the doors slide.

k k, l l, the sliding doors.

m, the hole in one of the doors; *n*, the semicircular hole.

o o, the holes for receiving the bars which support the muffle.

p,

Furnace. *p*, a hole above the upper edge of the upper door, for introducing a rod to stir the fire.

q, the pyramidal cover.

r, tube or funnel at the top.

s s, its handles.

Fig. 33. Fig. 33. represents a longitudinal section of a reverberatory furnace, 18 feet long, 12 broad, and 9½ high.

a, the building.

b, the ash-hole.

c, channel for the evaporation of the moisture.

d, the grate.

e, the fire-place.

f, the inner part of the furnace.

g, a bason formed of sand.

h, the cavity containing the melted metal.

i, a hole through which the scoria is removed.

k, the passage for the flame and smoke, or the lower part of the chimney, to be carried to the height of 30 feet.

l, a hole in the root, through which the ore is introduced into the furnace.

Fig. 34. Fig. 34. is a longitudinal section of a refining furnace.

a a, the building.

b, the channels to carry off the moisture.

c, other small channels, which meet in the middle of the bason.

d, the bason made of bricks.

e, a layer of ashes.

f, the hollow or bason containing the melted metal.

g, the hole for the smoke and flame.

h h, two openings for admitting the pipes of the bellows.

i, the vault or dome of the furnace.

k, the fire-place.

l, the grate.

m, a hole below for the admission of air.

n, a hole in the vault, which serves to cool the furnace.

Portable furnace. A convenient portable blast furnace, contrived by Mr Aikin, and described by him in the 17th vol. of the Philosophical Magazine, will probably be useful to some of our chemical readers. "It is (he says) particularly adapted to those who, like myself, can only devote a small room and a moderate share of time to these pursuits.

"Dr Lewis, in his Commerce of the Arts (page 27.), describes a very powerful blast furnace formed out of a black-lead pot, which has a number of holes bored at small distances in spiral lines all over, from the bottom up to such a height as the fuel is designed to reach to. This is let half way into another pot, which last receives the nozzle of the bellows, so that all the air sent in is distributed through the spiral holes of the upper pot, and concentrates the heat of the fuel upon the crucible, which is placed in the midst.

"The furnace which I am going to describe resembles very closely this of Dr Lewis; with this difference, however, that the air-holes are only bored through the bottom of the pot, and this merely stands upon another piece, instead of being let into it. It is on this account somewhat more commodious, and I imagine not less powerful.

Fig. 35. & 36. "Fig. 35. is a view, and fig. 36. a section, of the furnace. It is composed of three parts, all made out of the common thin black-lead melting pots sold in London for the use of the goldsmiths. The lower piece, A, in the bottom of one of the pots, cut off so low as only to leave a cavity of about one inch, and ground smooth above and below. The outside diameter over the top is 5½ inches. The middle piece or fire-place, B, is a larger portion of a similar pot with a cavity about six inches deep, and measuring 7½ inches over the top, outside diameter, and perforated with six blast holes at the bottom. These two pots are all that are essentially necessary to the furnace for most operations: but when it is wished to heap up fuel over the top of a crucible contained within, and especially to protect the eyes from the intolerable dazzle of the fire when in full heat, an upper pot, C, is added of the same dimensions as the middle one, and with a large side opening cut out to allow an exit to the smoke and flame. It has also an iron stem with a wooden handle (an old chisel will do very well), to lift it off and on.

"The bellows (which are double) are firmly fixed, by a little contrivance which will take off and on, to a heavy stool, as is represented in the plate; and their handle should be lengthened, to make them work easier to the hand. To increase their force on particular occasions, a plate of lead may be tied on the wood of the upper flap. The nozzle is received into a hole in the pot A, which conducts the blast into its cavity. From hence the air passes into the fire-place, B, through six holes, of the size of a large gimlet, drilled at equal distances through the bottom of the pot, and all converging in an inward direction, so that, if prolonged, they would meet about the centre of the upper part of the fire. The larger hole through the middle of the bottom of the same pot is for another purpose. Fig. 37. is a plan of the same, showing the distribution of these holes. Fig.

"As a stand or support for the crucible, I have found no method so good as to fit an earthen stopper into the bottom of the pot B, through the large centre hole which is made for this purpose. This keeps the crucible in its proper place, in stirring down the coals and managing the fuel. These stoppers are made with great ease and expedition out of the softened fire-brick sold in London. A piece of this brick, made to revolve a few times within a portion of iron or earthenware tube, presently takes the form of its cavity, and comes out a very neat portion of a cylinder or cone, according to the shape of the tube, from which the stoppers may readily be fashioned. Fig. 38. represents one of those stoppers, which is also seen in its proper place in fig. 36. supporting a crucible. Fig.

"As the construction of this furnace (exclusive of the bellows and its stool) it is easy to any one at all used to these little manual operations, I trust that the *working* chemist will allow me to add a few words on the method which I have found the most convenient and economical. Almost any broken pot of the proper width will furnish the lower piece A; and often the middle and upper pieces may be contrived out of the same refuse matter. Dr Lewis advises a saw to cut these pots; but

Fig. 1.

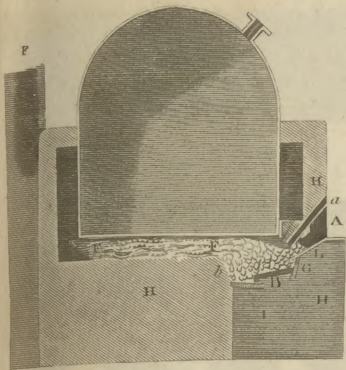


Fig. 2.

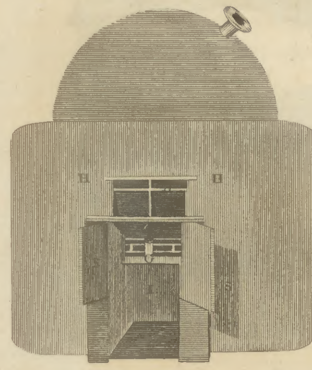


Fig. 5.

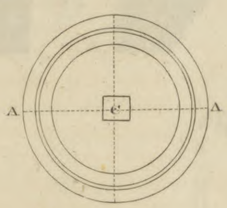


Fig. 3.

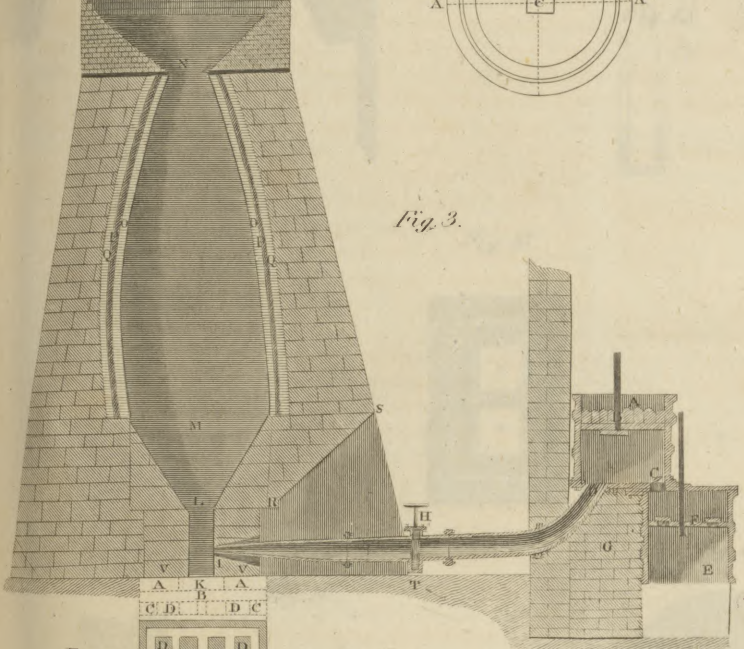


Fig. 4.

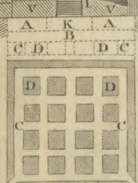


Fig. 6.

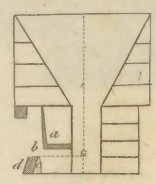


Fig. 7.

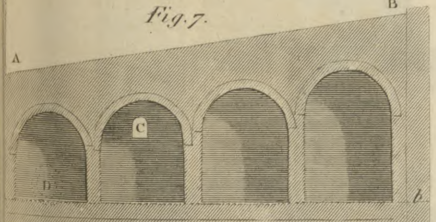


Fig. 8.

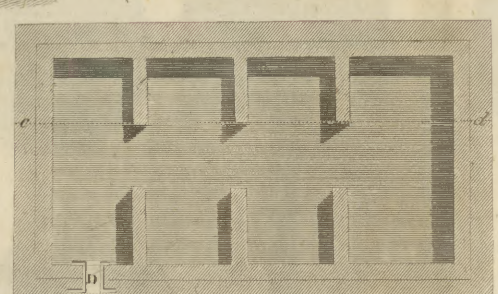


Fig. 9.

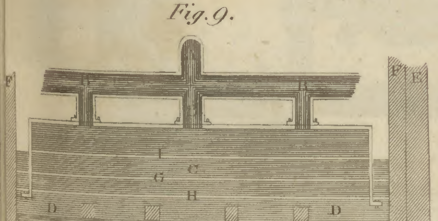
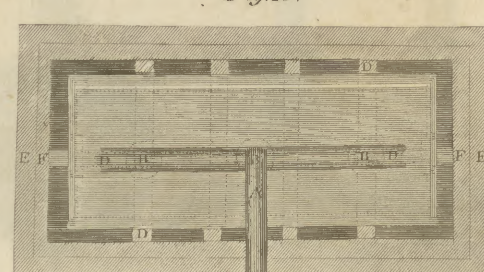


Fig. 10.



E. Mitchell sculp.t

Fig. 11.

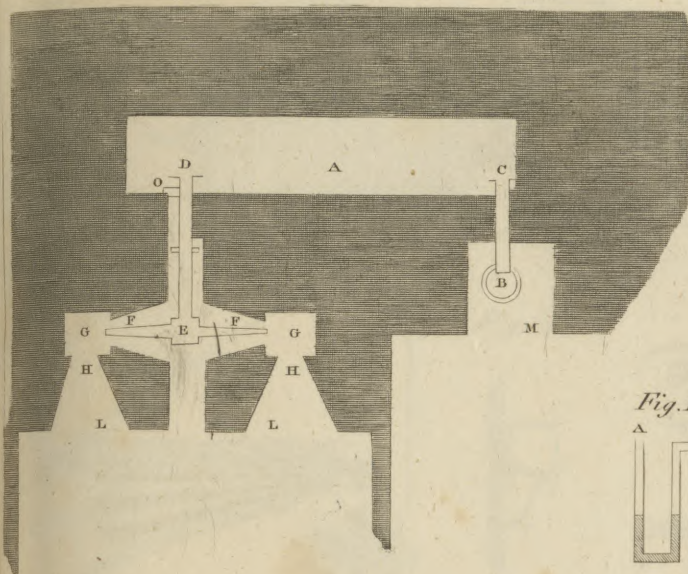


Fig. 13.

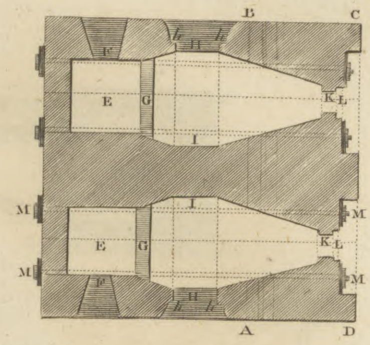


Fig. 12.

Fig. 14.

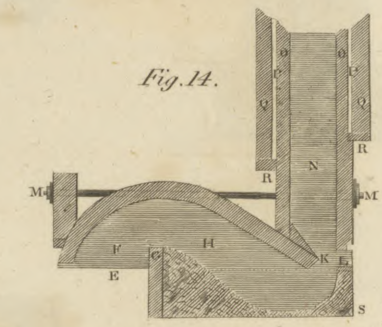


Fig. 15.

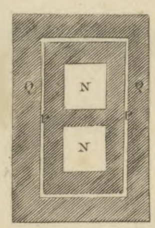


Fig. 20.

Fig. 18.

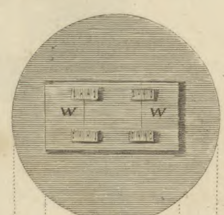


Fig. 16.

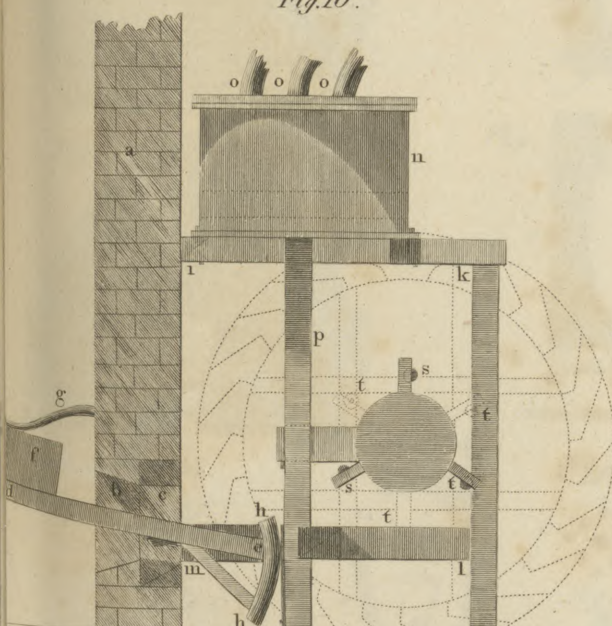


Fig. 17.

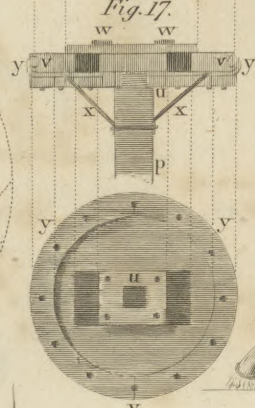
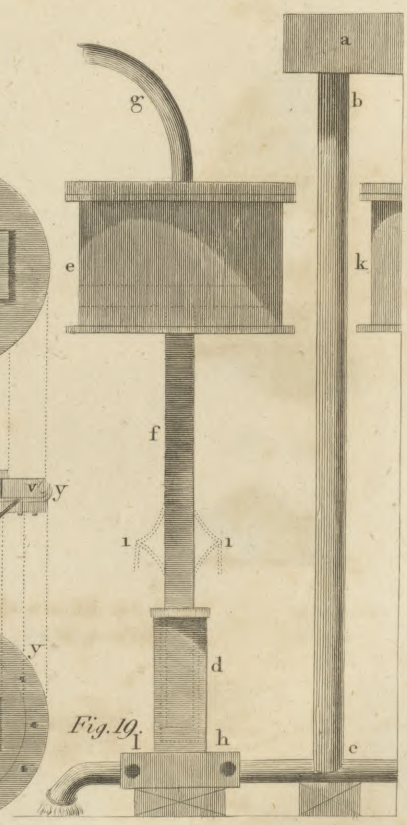


Fig. 19.



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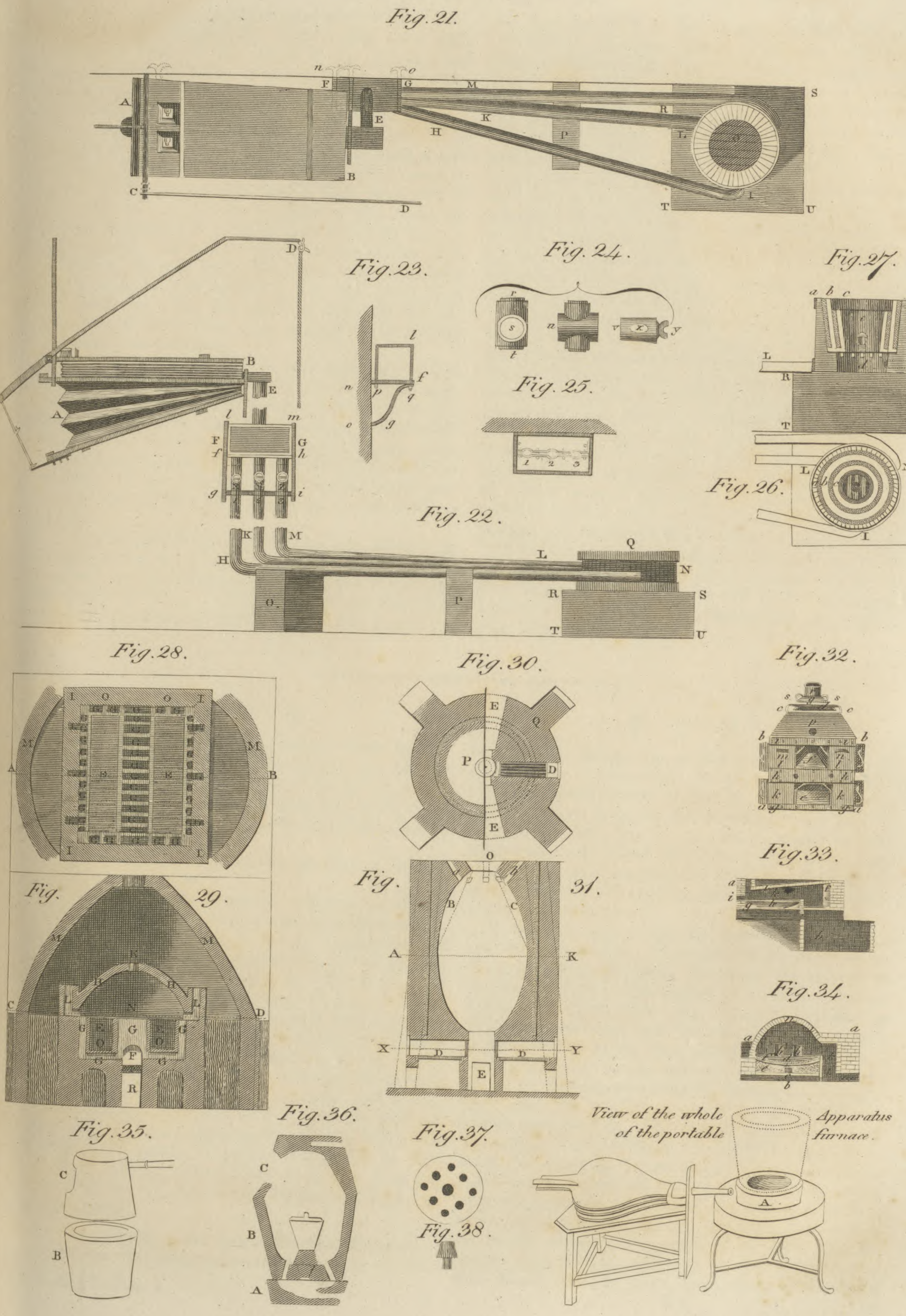

W. Archibald Sculp.t

but most saws are too thick, and when a little used, the teeth get rounded off, which makes them work intolerably slow. I have found by far the best tool to be an old table knife, or rather two of them, worn thin by use, and hacked and jagged as deeply as possible, by striking the edges strongly against each other. These work well and expeditiously, and when they become dull are again roughened by the same simple means. The holes may be drilled with a common gimlet of the largest size, and a little steadiness of hand will easily enable the operator to give them the oblique direction with sufficient accuracy; for much is not required. To make a smooth surface to the parts intended to adapt to each other, first wear them down a little with the soft fire-brick, and then grind them with water on a flat free-stone (a sink-stone for example), and lastly make them entirely fit by rubbing one surface on the other.

"No luting of any kind is ever required; so that the whole may be set up and taken down immediately. Nor is it necessary to bind the pots with metal hoops; for they are thick enough to endure considerable blows without breaking; and yet they will bear, without cracking, to be heated as suddenly and intensely as possible. In short, the black-lead crucible seems to be the best material that could possibly be devised for these purposes.

"The heat which this little furnace will afford is so intense, and so much more than would at first sight be expected from so trifling an apparatus, that it was only the accidental fusion of a thick piece of cast iron in it that led us to suspect its power. The utmost heat which we have procured in this furnace has been 167° of a Wedgwood pyrometer piece, which was withdrawn from a very small Hessian crucible when actually sinking down in a state of porcellaneous fusion. A steady heat of 150° to 155° may be usually depended on, if the fire be properly managed and the bellows worked with vigour. This is sufficient for most operations in chemistry; and the economy in time and fuel is extreme, since a furnace of the given dimensions will very well raise to the above point of heat in from five to ten minutes a Hessian crucible of such a diameter, that the average thickness of burning fuel around its bottom is not more than one inch and a half. A smaller crucible will take a higher heat, but at the risk of its softening and falling in by the weight of the incumbent fuel.

"Coak, or common cinders taken from the fire just when the coal ceases to blaze, and broken into very small pieces, with the dust sifted away, form the best fuel for the highest heat. A light spongy kind of coak, formed of a mixture of coal and charcoal, called *Davey's patent coal*, also answers extremely well. Charcoal alone has not weight enough, when broken so small as it must be to lie close in this little fire-place, to withstand the force of the blast when very violent. A bit of lighted paper, a handful of the very small charcoal, called in London *small coal*, and 10 or 12 strokes of the bellows, will kindle the fire in almost as many seconds.

"Various little alterations and arrangements, which will readily occur to the practical chemist, will fit this little apparatus for distillation with an earthern retort, heating a gun-barrel passed through the fire, bending glass tubes, &c."

FURNITURE, a term in dialling, which denotes certain additional points and lines drawn on a dial, by way of ornament, such as the signs of the zodiac, length of days, parallels of declination, azimuths, points of the compass, meridians of chief cities, Babylonic, Jewish, or Italian hours, &c.

FUROR UTERINUS, a disorder peculiar to women. See MEDICINE *Index*.

FURR, or FUR, in *Commerce*, signifies the skin of several wild beasts, dressed in alum with the hair on; and used as a part of dress, by princes, magistrates, and others. The kinds most in use are those of the ermine, sable, castor, hare, rabbit, &c. See MUSTELLA.

It was not till the later ages that the furs of beasts became an article of luxury. The more refined nations of ancient times never made use of them; those alone whom the former stigmatized as barbarians were clothed in the skins of animals. Strabo describes the Indians covered with the skins of lions, panthers, and bears; and Seneca, the Scythians clothed with the skins of foxes and the lesser quadrupeds. Virgil exhibits a picture of the savage Hyperboreans, similar to that which our late circumnavigators can witness to in the clothing of the wild Americans, unseen before by any polished people.

Gens effræna virûm Riphæo tunditur Euro;
Et pecudum fulvis velantur corpora setis.

Most part of Europe was at this time in similar circumstances. Cæsar might be as much amazed with the skin-dressed heroes of Britain, as our celebrated Cook was at those of his new-discovered regions. What time has done to us, time, under humane conquerors, may effect for them. Civilization may take place; and those spoils of animals, which are at present essential for clothing, become the mere objects of ornament and luxury.

It does not appear that the Greeks or old Romans ever made use of furs. It originated in those regions where they most abounded, and where the severity of the climate required that species of clothing. At first it consisted of the skins only, almost in the state in which they were torn from the body of the beast; but as soon as civilization took place, and manufactures were introduced, furs became the lining of the dress, and often the elegant facing of the robes. It is probable that the northern conquerors introduced the fashion into Europe. We find, that about the year 522, when Totila king of the Visigoths reigned in Italy, the Suethons (a people of modern Sweden), found means, by help of the commerce of numberless intervening people, to transmit, for the use of the Romans, *saphilinas pelles*, the precious skins of the sables. As luxury advanced, furs, even of the most valuable species, were used by princes as linings for their tents: thus Marco Polo, in 1252, found those of the Cham of

Furr.

of Tartary lined with ermines and sables. He calls the last *zibelines* and *zambolines*. He says that those and other precious furs were brought from countries far north; from the *land of Darkness*, and regions almost inaccessible by reason of morasses and ice. The Welsh set a high value on furs as early as the time of Howel Dda, who began his reign about 940. In the next age, furs became the fashionable magnificence of Europe. When Godfrey of Boulogne and his followers appeared before the emperor Alexis Comnenus, on their way to the Holy Land, he was struck with the richness of their dresses, *tam ex ostro quam aurifrigio et niveo opere harmelino et ex mardrino grisioque et vario.* How different was the advance of luxury in France from the time of their great monarch Charlemagne, who contented himself with the plain fur of the otter! Our Henry I. wore furs; yet in his distress was obliged to change them for warm Welsh flannel. But in the year 1337 the luxury had got to such a head, that Edward III. enacted, that all persons who could not spend a hundred a-year should absolutely be prohibited the use of this species of finery. These, from their great expence, must have been foreign furs, obtained from the Italian commercial states, whose traffic was at this period boundless. How strange is the revolution in the fur trade! The north of Asia at that time supplied us with every valuable kind; at present we send, by means of the possession of Hudson's Bay, furs, to immense amount, even to Turkey and the distant China.

History of the FUR *Trade*.—During Captain Cook's last voyage to the Pacific ocean, besides the various scientific advantages which were derived from it, a new source of wealth was laid open to future navigators, by trading for furs of the most valuable kind on the north-west coast of America. The first vessel which engaged in the new branch of trade pointed out by that great navigator, was equipped by some gentlemen in China. She was a brig of 60 tons and 20 men, commanded by James Hanna. She sailed from the Typa the end of April 1785; proceeded to the northward, along the coast of China; passed through Diemen's straits, the south end of Japan; and arrived at Nootka in August following. Soon after her arrival, the natives, whom Captain Cook had left unacquainted with the effect of fire-arms, tempted probably by the diminutive size of the vessel (scarce longer than some of their own canoes) and the small number of her people, attempted to board her in open day; but were repulsed with considerable slaughter. This was the introduction to a firm and lasting friendship. Captain Hanna cured such of the Indians as were wounded; an unreserved confidence took place; they traded fairly and peaceably; a valuable cargo of furs was procured; and the bad weather setting in, he left the coast in the end of September, touched at the Sandwich islands, and arrived at Macao the end of December the same year.

Captain Hanna sailed again from Macao in May 1786, in the snow Sea-Otter of 120 tons and 30 men, and returned to Macao in February 1787. In this second voyage he followed his former track, and arrived at Nootka in August; traced the coast from thence as far as 53 degrees, and explored the extensive sound discovered a short time before by Mr Strange, and called by him Queen Charlotte's sound, the latitude of which is 51 degrees north, longitude 128 west.

The snow Lark, Captain Peters, of 220 tons and 40 men, sailed from Macao in July 1786. Her destination was Kamtschatka (for which she was provided with a suitable cargo of arrack, tea, &c.), Copper islands, and the N. W. coast. Captain Peters was directed to make his passage between Japan and Corea, and examine the islands to the north of Japan, said to be inhabited by hairy people; which, if Captain Cook had lived, would not have been left to the French to determine. No account having been received of this vessel since her departure, there is every reason to fear she has perished.

In the beginning of 1786, two coppered vessels were fitted out at Bombay, under the direction of James Strange, Esq. who was himself a principal owner. These vessels were the snow Captain Cook of 300 tons, and snow Experiment of 100 tons. They proceeded in company from the Malabar coast to Batavia; passed through the straits of Macassar, where the Experiment was run upon a reef, and was obliged to haul ashore upon Borneo to repair; from thence they steered to the eastward of the Palaos islands; made Sulphur island; and arrived at Nootka the end of June following. From Nootka, where they left their surgeon's mate (Mackay) to learn the language and collect skins against their intended return (but who was brought away in the Imperial Eagle the following year), they proceeded along the coast to Queen Charlotte's sound, of which they were the first discoverers; from thence in a direct course to Prince William's sound. After some stay there, the Experiment proceeded to Macao (their vessels being provided with passes by the governor-general of Goa): the Captain Cook endeavoured to get to Copper island, but without success, being prevented by constant west winds.

Two coppered vessels were also fitted out by a society of gentlemen in Bengal, viz. the snow Nootka of 200 tons, and the snow Sea Otter of 100 tons, commanded by John Meares and William Tipping, lieutenants in the royal navy. The Nootka sailed in March 1786 from Bengal; came through the China seas; touched at the Bashees, where they were very civilly treated by the Spaniards, who have taken possession of these islands; arrived at Oonalashka the beginning of August; found there a Russian galliot and some furriers; discovered accidentally near Cape Greville a new strait near Cook's river, 15 leagues wide and 30 long; saw some Russian hunters in a small bay between Cape Elizabeth and Cape Bear; and arrived in Prince William's sound the end of September. They determined wintering in Snug Corner Cove, lat. 60. 30. in preference to going to the Sandwich islands, which seem placed by Providence for the comfort and refreshment of the adventurers in this trade, and were frozen up in this gloomy and frightful spot from the end of November to the end of May. By the severity of the winter they lost their third and fourth mates, surgeon, boatswain, carpenter, and cooper, and twelve of the fore-mast-men; and the remainder were so enfeebled as to be under the necessity of apply-

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ing to the commanders of the King George and Queen Charlotte, who just at this time arrived in the sound, for some hands to assist in carrying the vessel to the Sandwich islands, where, giving over all further thoughts of trade, they determined (after getting a sea-stock of fish off Cape Edgecumbe) immediately to proceed. The Nootka arrived at Macao the end of October 1787.

The Imperial Eagle, Captain Barkley, fitted out by a society of gentlemen at Ostend, sailed from Ostend the latter end of November 1786; went into the bay of All Saints; from thence, without touching anywhere, to the Sandwich islands, and arrived at Nootka the beginning of June; from thence to the south, as far as 47° 30′, in which space he discovered some good and spacious harbours. In the lat. of 47° 46′, lost his second mate, purser, and two seamen, who were upon a trading party with the long-boat, and imprudently trusting themselves ashore unarmed, were cut off by the natives. This place seems to be the same that Don Antonio Mourelle calls the *Ilha de los Dolores*, where the Spaniards going ashore to water, were also attacked and cut off.

The King George of 320, and the Queen Charlotte of 200 tons, commanded by Captains Portlock and Dixon, who served under Captain Cook in his last voyage, were fitted out by a society of gentlemen in England, who obtained a privilege to trade to the north-west coast of America, from the South Sea and East India companies.

These vessels sailed from England the beginning of September 1785; touched at the Falkland islands, Sandwich islands, and arrived at Cook's river in the month of August. From thence, after collecting a few furs, they steered in the end of September for Prince William's sound, intending, it is said, to winter there; but were prevented entering by heavy storms and extreme bad weather, which obliged them to bear away, and seek some other part of the coast to winter at. The storms and bad weather accompanied them till they arrived off Nootka sound, when they were so near the shore, that a canoe came off to them: but though thus near accomplishing their purpose, a fresh storm came on, and obliged them finally to bear away for the Sandwich islands, where they remained the winter months; and returning again to the coast, arrived in Prince William's sound the middle of May. The King George remained in Prince William's sound; and during her stay, her long-boat discovered a new passage from the sound into Cook's river. The Queen Charlotte proceeded along the coast to the south; looked into Behring's bay, where the Russians have now a settlement; examined that part of the coast from 56° to 50°, which was not seen by Captain Cook, and which consists of a cluster of islands, called by Captain Dixon *Queen Charlotte's Islands*, at a considerable distance from the main, which is thus removed farther to the eastward than it was supposed to be: some part of the continent may, however, be seen from the east side of these islands; and it is probable the distance does not anywhere exceed 50 leagues. On this estimation, Hudson's House, lat. 53°, long. 106° 27′ west, will not be more than 800 miles distant from that part of this coast in the same parallel. It is therefore not improbable, that the enterprising spirit of our Canadian furriers may penetrate to this coast (the communication with which is probably much facilitated by lakes or rivers), and add to the comforts and luxuries of Europe, this invaluable fur, which in warmth, beauty, and magnificence, far exceeds the richest furs of Siberia. Queen Charlotte's islands are inhabited by a race of people differing in language, features, and manners, from all the other tribes of this coast. Among other peculiarities, they are distinguished by a large incision in the under lip, in which is inserted a piece of polished wood, sometimes ornamented with mother of pearl shell, in shape and size like a weaver's shuttle, which undoubtedly is the most effectual mode of deforming the human face divine that the ingenious depravity of taste of any savage nation has yet discovered. These ships, after disposing of their furs in China, were loaded with teas on account of the English company, sailed from Wampoa, and arrived in England, after an absence of three years.

The year after the departure of the King George and Queen Charlotte, the same society to which they belonged fitted out two other vessels, viz. the Princess Royal of 60 tons, and the Prince of Wales of 200 tons, commanded by Captains Colnet and Duncan, the former of whom had served under Captain Cook. These vessels left England in August 1786; touched at New Year's harbour on Staten Land, where they left an officer and 12 men to kill seals against the arrival of a vessel which was to follow them from England; from thence they proceeded directly to Nootka, where they arrived the 6th of July, sickly and in bad condition, and found here the Imperial Eagle, which had left Europe some months after them. Leaving Nootka, they steered along the shore to the northward, and soon after fell in with the Queen Charlotte.

In the beginning of 1788, Captain Meares sailed again with two other vessels, the Felice, which he commanded himself, and the Iphigenia, Captain Douglas, to Nootka sound. Here he purchased of the chief of the district a spot, on which he built a house for his residence and more convenient intercourse with the natives, hoisting the British colours thereon, surrounding it with a breast-work, and mounting a three pounder on the front. Having so done, he sent Mr Douglas in the Iphigenia to trade along the northern coast, while he himself proceeded to the south; and by presents to the chiefs obtained the ports Cox and Effingham, and the promise of an excellent trade with the natives of the district, and also some other places, which he took possession of in the name of the king. Captain Douglas likewise, by presents to the chiefs of the countries he visited, obtained similar privileges, no other European vessel having sailed there before him.

On their return to Nootka, they found a vessel finished which the commander had laid down before his departure. This, which he named the North-West America, he left at Nootka with the Iphigenia, while he sailed with a cargo of furs in the Felice to China.

A few days after his arrival at China, two vessels, the Prince of Wales and Princess Royal, came to Canton from their trading voyage above mentioned. Captain Meares, fearing a competition of interests might be injurious to both parties, proposed a copartnership, which was mutually agreed to; and another ship was purchased by the firm, and called the *Argonaut*. In the month of April 1787, Captain Meares gave Mr Colnet the command of the Princess Royal and Argonaut, which were loaded with stores and articles estimated sufficient for three years trade, besides several artificers, and near 70 Chinese, who intended to become settlers on the north-west coast of America, under protection of the new company.

In the mean while, the Iphigenia, and North-West America (the vessel built at Nootka), having wintered in Sandwich islands, returned to Nootka in the latter end of April. Soon after which, two Spanish ships of war, under the command of Don Martinez, anchored in the sound. For a few days mutual civilities passed between the Spanish captain and Mr Douglas; but at the end of about a week, Don Martinez summoned the latter on board his own ship the Princessa, telling him he was his prisoner, and that the king of Spain had commanded him, Don Martinez, to seize all vessels he should find on that coast. He therefore instructed his officers to take possession of the Iphigenia, which they accordingly did in the name of his Catholic majesty; and the officers and crew were conveyed as prisoners on board the Spanish ships, where they were put in irons, and otherwise ill treated. Immediately after this, Don Martinez took possession of the little settlement, hoisting the standard of Spain, and modestly declaring all the lands from Cape Horn to 60 degrees north latitude belonging to his master. To aggravate the insult, he forcibly employed the crew of the Iphigenia in building batteries, &c. and offered no kind of violence to two American vessels that were at the same time in the harbour. At this time the North-West America was sent to explore the Archipelago of St Lazarus. On her return to Nootka, she met with a similar treatment, and the skins she had collected were seized, with the rest of her cargo.

A few days after the Princess Royal (which we have mentioned as leaving Canton in company with the Argonaut) arrived. The Spanish commander, for reasons that do not appear, suffered her to depart. The skins collected by the North-west America were shipped on board her for the benefit of her owner, and she proceeded to trade in the neighbouring isles. On the 3d of July, the Argonaut arrived at the sound; and Don Martinez, after making every profession of civility to Mr Colnet the commander, took possession of the said ship in the name of his master, and made prisoners of the crew. Soon after, the Princess Royal returning to receive instructions from Mr Colnet, director of the enterprise, was seized by the Spanish captain.

The crews of the British vessels were differently disposed of; some sent to China by the American vessels, and others to Spanish America: but the Chinese were all detained, and employed in the mines which were opened on the lands purchased by Captain Mears. What these mines consisted of, we are nowhere informed. Mr Colnet was so much affected at the failure of the enterprise, as to be deprived of reason.

This, as soon as known, occasioned a spirited representation from the British court to that of Spain; at the same time that vigorous preparations were made for war in case adequate satisfaction should be refused. Matters, however, were prevented from coming to extremities, by a compliance on the part of Spain, after many delays and much artifice of negotiation, with the requisitions of Britain: in consequence of which, among other advantages unnecessary to be here recited, the whole trade from California to China is completely laid open; and the British allowed the full exercise of navigation and commerce in those parts of the world which were the subject of discussion.

In some accounts of the voyages above mentioned, the fur trade in those parts has been greatly magnified. In that published by Captain Portlock, however, this officer observes, that the gains hitherto have certainly not been enviably great; although the merchants have no doubt found the trade lucrative.

History of the FUR *Trade from Canada to the North-west.*—The following account of this trade is extracted from Mr M'Kenzie's Narrative of his Voyages and Travels from Montreal, through the North-west Continent of America, and to the Pacific ocean.

"The fur trade, he says, from the earliest settlement of Canada, was considered of the first importance to that colony. The country was then so populous, that, in the vicinity of the establishments, the animals whose skins were precious in a commercial view, soon became very scarce, if not altogether extinct. They were, it is true, hunted at former periods, but merely for food and clothing. The Indians, therefore, to procure the necessary supply, were encouraged to penetrate into the country, and were generally accompanied by some of the Canadians, who found means to induce the remotest tribes of natives to bring the skins which were most in demand, to their settlements, in the way of trade.

"It is not necessary for me to examine the cause, but experience proves that it requires much less time for a civilized people to deviate into the manners and customs of savage life, than for savages to rise into a state of civilization. Such was the event with those who thus accompanied the natives on their hunting and trading excursions; for they became so attached to the Indian mode of life, that they lost all relish for their former habits and native homes. Hence they derived the title of *Coureurs des Bois*, became a kind of pedlars, and were extremely useful to the merchants engaged in the fur trade; who gave them the necessary credit to proceed on their commercial undertakings. Three or four of these people would join their stock, put their property into a birch-bark canoe, which they worked themselves, and either accompanied the natives in their excursions, or went at once to the country where they knew they were to hunt. At length, these voyages extended to 12 or 15 months, when they returned with rich cargoes of furs, and followed by great numbers of the natives. During the short time requisite to settle their accounts with the merchants, and procure fresh credit, they generally contrived to squander away all their gains, when they returned to their favourite mode of life: their views being answered, and their labour sufficiently rewarded, by indulging themselves in extravagance and dissipation during the short space of one month in 12 or 15.

"The indifference about amassing property, and the pleasure of living free from all restraint, soon brought on a licentiousness of manners which could not long escape the vigilant observation of the missionaries, who

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had much reason to complain of their being a disgrace to the Christian religion; by not only swerving from its duties themselves, but by thus bringing it into disrepute with those of the natives who had become converts to it; and, consequently, obstructing the great object to which those pious men had devoted their lives. They, therefore, exerted their influence to procure the suppression of these people, and accordingly no one was allowed to go up the country to traffic with the Indians, without a license from the government.

"At length, military posts were established at the confluence of the different large lakes of Canada, which, in a great measure, checked evil consequences that followed from the improper conduct of these foresters, and, at the same time, protected the trade. Besides, a number of able and respectable men, retired from the army, prosecuted the trade in person, under their respective licenses, with great order and regularity, and extended it to such a distance, as, in those days, was considered to be an astonishing effort of commercial enterprise. These persons and the missionaries having combined their views at the same time, secured the respect of the natives, and the obedience of the people necessarily employed in the laborious parts of this undertaking. These gentlemen denominated themselves commanders, and not traders, though they were intitled to both those characters: and, as for the missionaries, if sufferings and hardships in the prosecution of the great work which they had undertaken, deserved applause and admiration, they had an undoubted claim to be admired and applauded: they spared no labour and avoided no danger in the execution of their important office; and it is to be seriously lamented, that their pious endeavours did not meet with the success which they deserved: for there is hardly a trace to be found, beyond the cultivated parts, of their meritorious functions.

"The cause of this failure must be attributed to a want of due consideration in the mode employed by the missionaries to propagate the religion of which they were the zealous ministers. They habituated themselves to the savage life, and naturalized themselves to the savage manners, and, by thus becoming dependant, as it were, on the natives, they acquired their contempt rather than their veneration. If they had been as well acquainted with human nature, as they were with the articles of their faith, they would have known, that the uncultivated mind of an Indian must be disposed by much preparatory method and instruction to receive the revealed truths of Christianity, to act under its sanctions, and be impelled to good by the hope of its rewards, or turned from evil by the fear of its punishments. They should have begun their work by teaching some of those useful arts which are the inlets of knowledge, and lead the mind by degrees to objects of higher comprehension. Agriculture, so formed to fix and combine society, and so preparatory to objects of superior consideration, should have been the first thing introduced among a savage people: it attaches the wandering tribe to that spot where it adds so much to their comforts; while it gives them a sense of property, and of lasting possession, instead of the uncertain hopes of the chase, and the fugitive produce of uncultivated wilds. Such were the means by which the forests of Paraguay were converted into a scene of abundant cultivation, and its savage inhabitants introduced to all the advantages of a civilized life.

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"The Canadian missionaries should have been contented to improve the morals of their own countrymen, so that by meliorating their character and conduct, they would have given a striking example of the effect of religion in promoting the comforts of life to the surrounding savages; and might by degrees have extended its benign influence to the remotest region of that country, which was the object, and intended to be the scene, of their evangelic labours. But by bearing the light of the gospel at once to the distance of 2500 miles from the civilized part of the colonies, it was soon obscured by the cloud of ignorance that darkened the human mind in those distant regions.

"The whole of their long route I have often travelled, and the recollection of such a people as the missionaries having been there, was confined to a few superannuated Canadians, who had not left that country since the cession to the English, in 1763, and who particularly mentioned the death of some, and the distressing situation of them all. But if these religious men did not attain the objects of their persevering piety, they were, during their mission, of great service to the commanders who engaged in those distant expeditions, and spread the fur trade as far west as the bank of the Saskatchiwine river, in 53° north latitude, and longitude 102° west.

"At an early period of their intercourse with the savages, a custom was introduced of a very excellent tendency, but is now unfortunately discontinued, of not selling any spirituous liquor to the natives. This admirable regulation was for some time observed, with all the respect due to the religion by which it was sanctioned, and whose severest censures followed the violation of it. A painful penance could alone restore the offender to the suspended rites of the sacrament. The casuistry of trade, however, discovered a way to gratify the Indians with their favourite cordial, without incurring the ecclesiastical penalties, by giving, instead of selling it to them.

"But notwithstanding all the restrictions with which commerce was oppressed under the French government, the fur trade was extended to the immense distance which has been already stated; and surmounted many most discouraging difficulties, which will be hereafter noticed; while, at the same time, no exertions were made from Hudson's Bay to obtain even a share of the trade of a country which, according to the charter of that company, belonged to it, and, from its proximity, is so much more accessible to the mercantile adventurer.

"Of these trading commanders, I understood, that two attempted to penetrate to the Pacific ocean, but the utmost extent of their journey I could never learn; which may be attributed, indeed, to a failure of the undertaking.

"For some time after the conquest of Canada, this trade was suspended, which must have been very advantageous to the Hudson's Bay company, as all the inhabitants to the westward of Lake Superior were obliged to go to them for such articles as their habitual use had rendered necessary. Some of the Canadians who had lived long with them, and were become attached

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tached to a savage life, accompanied them thither annually, till mercantile adventurers again appeared from their own country, after an interval of several years, owing, I suppose, to an ignorance of the country in the conquerors, and their want of commercial confidence in the conquered. There were, indeed, other discouragements, such as the immense length of the journey necessary to reach the limits beyond which this commerce must begin; the risk of property; the expences attending such a long transport; and an ignorance of the language of those who, from their experience, must be necessarily employed as the intermediate agents between them and the natives. But, notwithstanding these difficulties, the trade, by degrees, began to spread over different parts to which it had been carried by the French, though at a great risk of the lives, as well as the property, of their new possessors, for the natives had been taught by their former allies to entertain hostile dispositions towards the English, from their having been in alliance with their natural enemies the Iroquois; and there were not wanting a sufficient number of discontented, disappointed people to keep alive such a notion; so that for a long time they were considered and treated as objects of hostility. To prove this disposition of the Indians, we have only to refer to the conduct of Pontiac, at Detroit, and the surprise and taking of Michilimakinac, about this period.

"Hence it arose, that it was so late as the year 1766, before which the trade I mean to consider commenced from Michilimakinac. The first who attempted it were satisfied to go the length of the river Camenistiquia, about 30 miles to the eastward of the Grande Portage, where the French had a principal establishment, and was the line of their communication with the interior country. It was once destroyed by fire. Here they went, and returned successful in the following spring to Michilimakinac. Their success induced them to renew their journey, and incited others to follow their example. Some of them remained et Camenistiquia, while others proceeded to and beyond the Grande Portage, which since that time has become the principal entrepot of that trade, and is situated in a bay, in latitude 48. north, and longitude 90. west. After passing the usual season there, they went back to Michilimakinac as before, and encouraged by the trade, returned in increased numbers. One of these, Thomas Curry, with a spirit of enterprise superior to that of his contemporaries, determined to penetrate to the furthest limits of the French discoveries in that country; or at least till the frost should stop him. For this purpose he procured guides and interpreters, who were acquainted with the country, and with four canoes arrived at Fort Bourbon, which was one of their posts, at the west end of the Cedar lake, on the waters of the Saskatchiwine. His risk and toil were well recompensed, for he came back the following spring with his canoes filled with fine furs, with which he proceeded to Canada, and was satisfied never again to return to the Indian country.

"From this period people began to spread over every part of the country, particularly where the French had established settlements *."

After continuing the detail of the history of the trade, for which we must refer to the work itself, Mr Mackenzie proceeds to inform us of the concern which he himself had in it, when in the year 1785, he was assumed as a partner, on condition of going into the Indian country to take an active share in the business. After some struggles, from jealousy and rivalship, with another company who had been some time in the trade, a union between the two companies was formed. This happened in 1787, and the following is Mr Mackenzie's account of its success, and of the extent and mode of conducting this trade.

"This commercial establishment," he proceeds, "was now founded on a more solid basis than any hitherto known in the country; and it not only continued in full force, vigour, and prosperity, in spite of all interference from Canada, but maintained at least an equal share of advantage with the Hudson's Bay Company, notwithstanding the superiority of their local situation. The following account of this self-erected concern will manifest the cause of its success.

"It assumed the title of the North-West Company, and was no more than an association of commercial men, agreeing among themselves to carry on the fur trade, unconnected with any other business, though many of the parties engaged had extensive concerns altogether foreign to it. It may be said to have been supported entirely upon credit; for whether the capital belonged to the proprietor, or was borrowed, it equally bore interest, for which the association was annually accountable. It consisted of twenty shares, unequally divided among the persons concerned. Of these, a certain proportion was held by the people who managed the business in Canada, and were styled agents for the Company. Their duty was to import the necessary goods from England, store them at their own expence at Montreal, get them made up into the articles suited to the trade, pack and forward them, and supply the cash that might be wanting for the outfits; for which they received, independent of the profit on their shares, a commission on the amount of the accounts, which they were obliged to make out annually, and keep the adventure of each year distinct. Two of them went annually to the Grande Portage, to manage and transact the business there, and on the communication at Detroit, Michilimakinac, St Mary's, and Montreal, where they received stores, packed up, and shipped the company's furs for England, on which they had also a small commission. The remaining shares were held by the proprietors, who were obliged to winter and manage the business of the concern with the Indians, and their respective clerks, &c. They were not supposed to be under any obligation to furnish capital, or even credit. If they obtained any capital by the trade, it was to remain in the hands of the agents; for which they were allowed interest. Some of them, from their long services and influence, held double shares, and were allowed to retire from the business at any period of the existing concern, with one of those shares, naming any young man in the company's service to succeed him in the other. Seniority and merit were, however, considered as affording a claim to the succession, which, nevertheless, could not be disposed of without the concurrence of the majority of the concern; who, at the same time relieved the seceding person from any responsibility respecting the share that he transferred, and accounted for it according to the annual value or rate of the property; so that the seller could have no advantage but that of getting the

* *Gen. Hist. of the Fur Trade*, p. 1.

the share of stock which he retained realised, and receiving for the transferred share what was fairly determined to be the worth of it. The former was also discharged from all duty, and became a dormant partner. Thus, all the young men who were not provided for at the beginning of the contract, succeeded in succession to the character and advantages of partners. They entered into the company's service for five or seven years, under such expectations, and their reasonable prospects were seldom disappointed: there were indeed, instances when they succeeded to shares, before their apprenticeship was expired, and it frequently happened that they were provided for while they were in a state of articled clerkship. Shares were transferable only to the concern at large, as no person could be admitted as a partner who had not served his time to the trade. The dormant partner indeed might dispose of his interest to any one he chose, but if the transaction were not acknowledged by his associates, the purchaser could only be considered as his agent or attorney. Every share had a vote, and two thirds formed a majority. This regular and equitable mode of providing for the clerks of the company, excited a spirit of emulation in the discharge of their various duties, and, in fact, made every agent a principal, who perceived his own prosperity to be immediately connected with that of his employers. Indeed, without such a spirit, such a trade could not have become so extended and advantageous, as it has been and now is,

"In 1788, the gross amount of the adventure for the year did not exceed 40,000l.: but by the exertion, enterprise, and industry of the proprietors, it was brought in eleven years to triple that amount and upwards; yielding proportionate profits, and surpassing, in short, any thing known in America.

"Such, therefore, being the prosperous state of the company, it, very naturally, tempted others to interfere with the concern in a manner by no means beneficial to the company, and commonly ruinous to the undertakers.

"In 1798 the concern underwent a new form, the shares were increased to forty-six, new partners being admitted, and others retiring. This period was the termination of the company, which was not renewed by all the parties concerned in it, the majority continuing to act upon the old stock, and under the old firm; the others beginning a new one; and it now remains to be decided, whether two parties, under the same regulations and by the same exertions, though unequal in number, can continue to carry on the business to a successful issue. The contrary opinion has been held, which, if verified, will make it the interest of the parties again to coalesce: for neither is deficient in capital to support their obstinacy in a losing trade, as it is not to be supposed that either will yield on any other terms than perpetual participation.

"It will not be superfluous in this place, to explain the general mode of carrying on the fur trade.

"The agents are obliged to order the necessary goods from England in the month of October, eighteen months before they can leave Montreal; that is, they are not shipped from London until the spring following, when they arrive in Canada in the summer. In the course of the following winter they are made up into such articles as are required for the savages; they are then packed into parcels of ninety pounds weight each, but cannot be sent from Montreal until the May following; so that they do not get to market until the ensuing winter, when they are exchanged for furs, which come to Montreal the next fall, and from thence are shipped, chiefly to London, where they are not sold or paid for before the succeeding spring, or even as late as June; which is forty-two months after the goods were ordered in Canada; thirty-six after they had been shipped from England; and twenty-four after they had been forwarded from Montreal; so that the merchant, allowing that he has twelve months credit, does not receive a return to pay for those goods, and the necessary expences attending them, which is about equal to the value of the goods themselves, till two years after they are considered as cash, which makes this a very heavy business. There is even a small proportion of it that requires twelve months longer to bring round the payment, owing to the immense distance it is carried, and from the shortness of the seasons, which prevent the furs, even after they are collected, from coming out of the country for that period (A).

"The articles necessary for this trade, are coarse woollen cloths of different kinds; milled blankets of different sizes; arms and ammunition; twist and carrot tobacco; Manchester goods; linens, and coarse sheetings; thread, lines, and twine; common hardware; cutlery and ironmongery of several descriptions; kettles of brass and copper, and sheet-iron; silk and cotton handkerchiefs; hats, shoes, and hose; calicoes and printed cottons, &c. &c. &c. Spirituous liquors and provisions are purchased in Canada. These, and the expence of transport to and from the Indian country, including wages to clerks, interpreters, guides, and canoe-men, with the expence of making up the goods for the

(A) "This will be better illustrated by the following statement:

We will suppose the goods for 1798;	
The orders for the goods are sent to this country - - - - - -	25th Oct. 1796.
They are shipped from London - - - - - - - -	March 1797.
They arrive in Montreal - - - - - - - - -	June 1797.
They are made up in the course of that summer and winter.	
They are sent from Montreal - - - - - - - - -	May 1798.
They arrive in the Indian country, and are exchanged for furs the following winter -	1798-9.
Which furs come to Montreal - - - - - - - -	Sept. 1799.
And are shipped for London, where they are sold in March and April, and paid for in May or June - - - - - - - - - - -	1800.

the market, form about half the annual amount against the adventure.

"This expenditure in Canada ultimately tends to the encouragement of British manufactory, for those who are employed in the different branches of this business, are enabled by their gains to purchase such British articles as they must otherwise forego.

"The produce of the year of which I am now speaking, consisted of the following furs and peltries:

106,000 Beaver skins,	6000 Lynx skins,
2100 Bear skins,	600 Wolverine skins,
1500 Fox skins,	1650 Fisher skins,
4000 Kitt fox skins,	100 Rackoon skins,
4600 Otter skins,	3800 Wolf skins,
17,000 Musquash skins,	700 Elk skins,
32,000 Marten skins,	750 Deer skins,
1800 Mink skins,	1200 Deer skins dressed,

500 Buffalo robes, and a quantity of castoreum.

"Of these were diverted from the British market, being sent through the United States to China, 13,364 skins, fine beaver, weighing 19,283 pounds; 1250 fine otters, and 1724 kitt foxes. They would have found their way to the China market at any rate, but this deviation from the British channel arose from the following circumstance:

"An adventure of this kind was undertaken by a respectable house in London, half concerned with the North-West Company in the year 1792. The furs were of the best kind, and suitable to the market; and the adventurers continued this connexion for five successive years, to the annual amount of 40,000l. At the winding up of the concern of 1792, 1793, 1794, 1795, in the year 1797, (the adventure of 1796 not being included, as the furs were not sent to China, but disposed of in London), the North-West Company experienced a loss of upwards of 40,000l. (their half,) which was principally owing to the difficulty of getting home the produce procured in return for the furs from China, in the East India Company's ships, together with the duty payable, and the various restrictions of that company. Whereas, from America there are no impediments; they get immediately to market, and the produce of them is brought back, and perhaps sold in the course of twelve months. From such advantages the furs of Canada will no doubt find their way to China by America, which would not be the case if British subjects had the same privileges that are allowed to foreigners, as London would then be found the best and safest market.

"But to return to our principal subject.—We shall now proceed to consider the number of men employed in the concern: viz. 50 clerks, 71 interpreters and clerks, 1120 canoe men, and 35 guides. Of these, five clerks, 18 guides, and 350 canoe men, were employed for the summer season in going from Montreal to the Grande Portage, in canoes, part of whom proceeded from thence to Rainy Lake, as will be hereafter explained, and are called *pork-eaters*, or *goers and comers*. These were hired in Canada or Montreal, and were absent from the 1st of May till the latter end of September. For this trip the guides had from 800 to 1000 livres, and a suitable equipment; the foreman and steersman from 400 to 600 livres; the middle men from 250 to 350 livres, with an equipment of one blanket, one shirt, and one pair of trowsers; and were maintained during that period at the expence of their employers. Independent of their wages, they were allowed to traffic, and many of them earned to the amount of their wages. About one-third of these went to winter, and had more than double the above wages, and equipment. All the others were hired by the year, and some times for three years; and of the clerks many were apprentices, who were generally engaged for five or seven years, for which they had only 100l. provision and clothing. Such of them who could not be provided for as partners, at the expiration of this time, were allowed from 100l. to 300l. per annum, with all necessaries, till provision was made for them. Those who acted in the twofold capacity of clerk and interpreter, or were so denominated, had no other expectation than the payment of wages to the amount from 1000 to 4000 livres per annum, with clothing and provisions. The guides, who are a very useful set of men, acted also in the additional capacity of interpreters, and had a stated quantity of goods, considered as sufficient for their wants, their wages being from 1000 to 3000 livres. The canoe men are of two descriptions, foremen and steersmen, and middlemen. The two first were allowed annually 1200, and the latter 400, livres each. The first class had what is called an equipment, consisting of two blankets, two shirts, two pair of trowsers, two handkerchiefs, 14 pounds of tobacco, and some trifling articles. The latter had 10 pounds of tobacco, and all the other articles: those are called *north men*, or *winterers;* and to the last class of people were attached upwards of 700 Indian women and children, victualled at the expence of the company.

"The first class of people are hired in Montreal five months before they set out, and receive their equipments, and one-third of their wages in advance; and an adequate idea of the labour they undergo may be formed from the following account of the country through which they pass, and their manner of proceeding.

"The necessary number of canoes being purchased, at about 300 livres each, the goods formed into packages, and the lakes and rivers free of ice, which they usually are in the beginning of May, they are then dispatched from La Chine, eight miles above Montreal, with eight or ten men in each canoe, and their baggage; and 65 packages of goods, 600 weight of biscuit, 200 weight of pork, three bushels of pease, for the men's provision; two oil cloths to cover the goods, a sail, &c. an axe, a towing-line, a kettle, and a sponge to bail out the water, with a quantity of gum, bark, and watape, to repair the vessel. An European on seeing one of these slender vessels thus laden, heaped up, and sunk with her gunwale within six inches of the water, would think his fate inevitable in such a boat, when he reflected on the nature of her voyage; but the Canadians are so expert that few accidents happen *."

FURSTENBURGH, a town and castle of Germany, the capital of a county of the same name, 30 miles north-west of Constance. E. Long. 8. 27. N. Lat. 47. 57.

FURTHCOMING, in *Law*, the name of an action competent

competent to any person who has used arrestment in the hands of his debtor's creditor, for having the subject arrested declared his property.

FURUNCLE, or Boil, in *Surgery*, a small resisting tumour, with inflammation, redness, and great pain, arising in the adipose membrane, under the skin. See Surgery *Index*.

FURZE. See Ulex, Botany *Index*.

FUSANUS, in *Botany*, a genus of plants belonging to the polygamia class. The hermaphrodite calyx is quinquefid; there is no corolla; there are four stamina; the germen beneath; there are four stigmata; the fruit a plum.

FUSAROLE, in *Architecture*, a moulding or ornament placed immediately under the echinus, in the Doric, Ionic, and Composite capitals.

FUSE, or Fuze, in artillery. See Fusee.

FUSEE, in clock-work, is that conical part drawn by the spring, and about which the chain or string is wound; for the use of which, see Clock and Watch.

Fusee, or *Firelock*. See Musquet.

Fusee, *Fuze*, or *Fuse*, of a bomb or grenado, is that which makes the whole powder or composition in the shell take fire, to do the designed execution.

Fuzes are chiefly made of very dry beech wood, and sometimes of hornbeam, taken near the root. They are turned rough, and bored at first, and then kept for several years in a dry place; the diameter of the hole is about one-fourth of an inch; the hole does not come quite through, leaving about one-fourth of an inch at the bottom; and the head is made hollow, in the form of a bowl.

The composition for fuzes is saltpetre 3, sulphur 1, and mealed powder 3, 4, and sometimes 5. This composition is driven in with an iron driver (whose ends are capped with copper to prevent the composition from taking fire), and equally hard as possible; the last shovelfull being all mealed powder, and two stands of quickmatch laid across each other being driven in with it, the ends of which are folded up into the hollow top, and a cap of parchment tied over it till used.

When these fuzes are driven into the loaded shell, the lower end is cut off in a slope, so that the composition may inflame the powder in the shell: the fuze must have such a length as to continue burning all the time the shell is in its range, and to set fire to the powder as soon as it touches the ground, which instantly bursts into many pieces. When the distance of the battery from the object is known, the time of the shell's flight may be computed to a second or two; which being known, the fuze may be cut accordingly, by burning two or three, and making use of a watch or a string by way of a pendulum to vibrate seconds.

FUSIBILITY, in *Natural Philosophy*, that quality of bodies which renders them fusible. Gold is more fusible than iron or copper; but less so than silver, tin, and lead. Borax and other substances are frequently mixed with metals, to render them more fusible.

FUSIL, in *Heraldry*, a bearing of a rhomboidal figure, longer than the lozenge, and having its upper and lower angles more acute and sharp than the other two in the middle. It is called in Latin *fusus*, "a spindle," from its shape.

FUSILIERS, Fusileers, or *Fuzileers*, in the military art, are soldiers armed as the rest of the infantry, but formerly wore caps like the grenadiers, though somewhat shorter. There are three regiments in the British service: the royal regiment of Scotch fuzileers raised in 1678; the royal regiment of English fuzileers raised in 1685; and the royal regiment of Welsh fuzileers raised in 1688-9.

FUSION, the state of a body rendered fluid by fire. See Fluidity, and Chemistry *Index*.

FUST, or Faust, John, was a goldsmith of Mentz, and one of the three artists to whom the valuable invention of printing has been usually ascribed. The names of the other two were Guttemberg and Schœffer. It seems impossible, however, to determine with certainty, whether Fust had any other merit in the business than that of supplying Guttemberg with money, who had been making some attempts with carved blocks at Strasburgh, before he visited Mentz. To Schœffer, the son-in-law of Fust, we are indebted for the invention of punches and matrices, by means of which this noble art was afterwards carried to perfection. That work which may be regarded as the origin of the true typographic art, was the "Durandi Rationale Divinorum Officiorum," published in 1459, by Fust and Schœffer, which was soon followed by a copy of the Bible, both executed in a very masterly manner.

We are informed that Fust went to Paris in 1462, in order to dispose of a part of the second edition of his bible, which he was enabled to sell considerably lower than bibles in manuscript, yet some reckoned themselves overcharged by him, and some pretend that he was even accused of magic, but for the belief of this there appears to be no rational foundation. It seems certain that Fust was never in Paris after the year 1466; but that he was in that metropolis then, is proved by a note at the end of a copy of Cicero's Offices, intimating that the first possessor received it from John Fust at Paris, in 1466. It is extremely probable that he died that year of the plague, to which 40,000 of the inhabitanrs fell a sacrifice in the months of August and September. This opinion is farther corroborated by this circumstance, that the name of Schœffer alone was prefixed to the books which were published at Mentz after that period.

This man has been frequently confounded with John Faust, better known by the name of Dr Faustus, a pretender to the art of magic, who was first a theologian, then a student of medicine, and last of all sold himself to the devil for 24 years, at the expiration of which period it seems the devil came to carry off his purchase, and dashed out the doctor's brains against the wall about midnight. This wretched romance has no doubt been invented by the monks, to blacken the reputation of the great Fust, whose art deprived them of the emoluments arising from the copying of manuscripts. See (History of) Printing.

Fust, in *Architecture*, the shaft of a column, or the part comprehended between the base and the capital, called also the naked.

FUSTIAN, in *Commerce*, a kind of cotton stuff, which seems as it were whaled on one side.

Right fustians should be altogether made of cotton-yarn, both woof and warp; but a great many are made, the warp of which is flax, or even hemp.

There are fustians made of several kinds, wide, narrow, fine, coarse; with shag or nap, and without it.

FUSTIAN is also used for a bombast style, or a high swelling kind of writing, made up of heterogeneous parts.

FUSTICK, or FUSTOCK, a yellow wood, that grows in all the Caribbee islands, and is used in dyeing yellow. It is a species of MORUS. See BOTANY *Index*. And for its properties, see CHEMISTRY and DYEING *Index*.

FUSTIGATIO, in the Roman customs, a punishment inflicted by beating with a cudgel. This punishment was peculiar to freemen; for the slaves were scourged or lashed with whips.

FUTTOCKS, in a ship, the timbers raised over the keel, or the encompassing timbers that make her breadth.

FUTURE, something to come hereafter. We say, a *future* state, a *future* contingency: there is none but God to whom *future* things are present.

FUTURE, or FUTURE *Tense*, in *Grammar*, denotes an inflection of verbs, whereby they denote, that a thing will be in some time yet to come. See GRAMMAR.

FUZES, or FUSEES, in artillery. See FUSEE.

FUZILEERS. See FUSILEERS.

G.

G, THE seventh letter and fifth consonant of our alphabet; though in the alphabets of all the oriental languages, the Hebrew, Phenician, Chaldee, Syriac, Samaritan, Arabic, and even Greek, *G* is the third letter. The Hebrews call it *ghimel* or *gimel*, q. d. "camel;" by reason it resembles the neck of that animal; and the same appellation it bears in the Samaritan, Phenician, and the Chaldee; in the Syriac it is called *gamel*, in Arabic *giim*, and in Greek *gamma*.

The gamma (Γ) of the Greeks is manifestly the gimel (ג) of the Hebrews or Samaritans. All the difference between the gamma and gimel consists in this, that the one is turned to the right, and the other to the left, according to the different manners of writing and reading which obtained among those different nations; so that all the pains Salmasius has taken on Solinus, to prove that the G was derived from the Greek kappa, is lost.

From the Greeks the Latins borrowed their form of this letter; the Latin G being certainly a corruption of the Greek gamma Γ, as might easily be shown had our printers all the characters and forms of this letter which we meet with in the Greek and Latin MSS. through which the letter passed from Γ to G.

Diomed, lib. ii. cap. *De Litera*, calls G a new letter. His reason is, that the Romans had not introduced it before the first Punic war; as appears from the rostral column erected by C. Duilius, on which we everywhere find a C in lieu of G. It was Sp. Carvilius who first distinguished between those two letters, and invented the figure of the G; as we are assured by Terentius Scaurus. The C served very well for G; it being the third letter of the Latin alphabet, as the Γ or γ was of the Greek.

The G is found instead of C on several medals: *Vaillant. Num. Imperat.* tom. i. p. 39.

M. Beger produces a medal of the *Familia Ogulnia*, where GAR is read instead of CAR, which is on those of M. Patin. But the C is more frequently seen on medals in lieu of G; as, AUCUSTALIS CALLAECIA CARTACINENSIS, &c. for AUGUSTALIS, &c. Not that the pronunciation of those words was altered, but only that the G was unartfully or negligently cut by the workmen; as is the case in divers inscriptions of the eastern empire; where AVC, AUCC, AUCCC, are frequently found for AUG, &c.

The northern people frequently change the G into V or W; as in *Gallus*, *Wallus*; *Gallia*, *Wallia*, *Vallia*, &c. For, in this instance, it must not be said that the French have changed the W into G; because they wrote *Gallus* long before *Wallus* or *Wallia* was known, as appears from all the ancient Roman and Greek writers. And yet it is equally true, that the French change the W of the northern nations, and V consonant, into G; as, *Willielmus*, "William," into *Guillaume*; *Wulphilas* into *Gulphilas*; *Vascon* into *Gascon*, &c.

The letter G is of the mute kind, and cannot be any way sounded without the help of a vowel. It is formed by the reflection of the air against the palate, made by the tongue as the air passes out of the throat; which Martianus Capella expresses thus, G *spiritus cum palato*; so that G is a palatal letter.

The modern G takes its form from that of the Latins. In English it has two sounds, one from the Greek Γ and the Latin, which is called that of the hard G, because it is formed by a pressure somewhat hard on the fore part of the tongue against the upper gum; which sound it retains before *a*, *o*, *u*, *l*, *r*; as *gate*, *go*, *gull*. At the end of a word it is always hard, as *ring*, *sing*, &c. The other sound, called that of the soft G, resembles that of *j*; and is commonly, though not always, found before *e* and *i*, as in *gesture*, *giant*, &c. To this rule, however, there are many exceptions; G is often hard before *i*, as *give*, &c. and sometimes before *e*, as *get*, &c. It is also hard in derivatives from words ending in *g*, as *singing*, *stronger*, &c. and generally before *er*, at the ends of words, as *finger*. G is mute before *n*, as *gnash*, *sign*. *Gh* has the sound of the hard *G* in the beginning of a word, as *ghostly*; in the middle, and sometimes at the end, it is quite silent, as *right*, *though*. At the end of a word *Gh* has often the sound of *f*, as *laugh*, *rough*, *tough*.

As a numeral, G was anciently used to denote 400; and with a dash over it thus $\bar{G}$, 40,000.

As an abbreviature, G. stands for *Gaius*, *Gellius*, *gens*,

gens, *genius*, &c. G. G. for *gemina*, *gessit*, *gesserunt*, &c. G. C. for *genio civitatis* or *Cæsaris*. G. L. for *Gaius libertus*, or *genio loci*. G. V. S. for *genio urbis sacrum*. G. B. for *genio bono*. And G. T. for *genio tutelari*.

In music, G is the character or mark of the treble cleff; and from its being placed at the head, or marking the first sound in Guido's scale, the whole scale took the name of *gamut*.

GABALE, in *Mythology*, a deity worshipped at Heliopolis under the figure of a lion, with a radiant head; and it is thus represented on many medals of Caracalla.

GABARDINE, from the Italian *gavardina*, has been sometimes used to denote a coarse frock, or mean dress. In this sense it is used by Shakespeare in his Tempest and Merchant of Venice, and by Butler in his Hudibras, book i.

GABARA, or GABBARA, in antiquity, the dead bodies which the Egyptians embalmed, and kept in their houses, especially those of such of their friends as died with the reputation of great piety and holiness, or as martyrs. See EMBALMING, and MUMMY.

GABEL, (*Gabella*, *Gablum*, *Gablagium*), in French *Gabelle*, i.e. *Vectigal*, hath the same signification among the ancient English writers that *gabelle* hath in France. It is a tax; but hath been variously used, as for a rent, custom, service, &c. And where it was a payment of rent, those who paid it were termed *gablatores*. When the word *gabel* was formerly mentioned without any addition to it, it signified the tax on salt, though afterwards it was applied to all other taxes.

In the French customs, the gabel, or tax on salt, computed to make one-fourth of the whole revenue of the kingdom, is said to have had its rise in France in 1286, under Philip the Fair. Philip the Long took a double per livre on salt, by an edict in 1318, which he promised to remit when he was delivered from his enemies; which was renewed by Philip de Valois in 1345; and the duty was raised to four deniers per livre; King John resumed it in 1355, and it was granted to the dauphin in 1358, to ransom King John. It was continued by Charles V. in 1366; after his decease it was suppressed, but revived again by Charles VI. in 1381. Louis XI. raised it to 12 deniers per livre; and Francis I. in 1542 to 24 livres per muid: and it has been considerably augmented since that time; so that a minot of salt latterly paid a duty of 52 livres 8 sols and 6 deniers. Philip de Valois first established granaries and officers of the gabelles, and prohibited any other persons from selling salt: from which time the whole commerce of salt for the inland consumption continued wholly in the king's hands, every grain thereof being sold and distributed by his farmers and officers created for the purpose.—This oppressive tax was abolished by the National Assembly.

GABII, in *Ancient Geography*, a town of Latium, midway almost between Rome and Preneste to the east, often mentioned in the history of Tarquin the Proud. *Cinctus Gabinus* denoted a particular way of tucking the gown, by drawing it forwards on the breast, and tying it into a knot; as the people of Gabii did at a solemn sacrifice, on the sudden attack of an enemy, in order to be fitter for action. In this manner the consul used to declare war, to sacrifice, and burn the spoils of the enemy; and then he was said to be *præcinctus*. The place now extinct.

GABINIAN LAWS, in Roman antiquities; laws instituted upon several occasions by persons of the name of *Gabinius*. The first was the *Gabinia lex de Comitiis*, by A. Gabinius the tribune, in the year of Rome 614. It required, that in the public assemblies for electing magistrates, the votes should be given by tablets, and not *viva voce*.—Another *de Comitiis*, which made it a capital punishment to convene any clandestine assembly, agreeable to the old law of the 12 tables. Another *de Militia*, by A. Gabinius the tribune, year of Rome 685. It granted Pompey the power of carrying on the war against the pirates, during three years, and of obliging all kings, governors, and states, to supply him with all the necessaries he wanted, over all the Mediterranean sea, and in the maritime provinces as far as 400 *stadia* from the sea.—Another *de Usura*, by Aul. Gabinius the tribune, year of Rome 685. It ordained that no action should be granted for the recovery of any money borrowed upon small interest to be lent upon larger. This was an usual practice at Rome, which obtained the name of *versuram facere*.—Another against fornication.

GABIONS, in *Fortification*, baskets made of ozier twigs, of a cylindrical form, six feet high and four wide; which, being filled with earth, serve as a shelter from the enemy's fire.

GABLE or GABEL *End*, of a house (from *gaval*, Welsh), is the upright triangular end from the cornice or eaves to the top of the house.

GABRES, or GAVRES, a religious sect in Persia and India; called also *Gebres*, *Guebres*, *Gevres*, *Gaurs*, &c. Sea MAGI.

The Turks call the Christians *Gabres*, q. d. Infidels, or people of a false religion; or rather as Leunclavius observes, Heathens or Gentiles: the word *Gabre*, among the Turks, having the same signification as *Pagan* or *Infidel* among the Christians, and denoting any thing not Mahometan.

In Persia the word has a more peculiar signification; wherein it is applied to a sect dispersed through the country, and said to be the remains of the ancient Persians or followers of Zoroaster, being worshippers of fire. They have a suburb at Ispahan, which is called *Gaurabad*, or "the town of the *Gaurs*," where they are employed in the meanest and vilest drudgery; some of them are dispersed through other parts of Persia; but they principally abound in Kerman, the most barren province in the whole country, where the Mahometans allow them liberty and the exercise of their religion. Several of them fled many ages ago into India, and settled about Surat, where their posterity remain to this day. There is also a colony of them at Bombay. They are a poor, ignorant, inoffensive people, extremely superstitious, and zealous for their rights, rigorous in their morals, and honest in their dealings. They profess to believe a resurrection and a future judgment, and to worship only one God. And though they perform their worship before fire, and direct their devotion towards the rising sun, for which they have an extraordinary veneration, yet they strenuously maintain that they worship neither; but that these are the most expressive symbols of the Deity, and that for this reason they turn towards them in their devotional services.—However, some have supposed, that these are Persians converted to Christianity, who, being afterwards left to themselves, mingled their ancient superstitions with the truths and practices of Christianity, and so formed for themselves a religion apart: and they allege, that throughout the whole of their system of doctrine and practice, we may discern the marks and traces of Christianity, though grievously defaced; the annunciation, the magi, the massacre of the infants, our Saviour's miracles, his persecutions, ascension, &c.

GABRIEL, the name of one of the principal angels in heaven. It signifies *the strength of God.* There are a few events, in which this exalted being was concerned, recorded in Scripture. He was sent to the prophet Daniel, to explain to him the vision of the ram and goat, and the mystery of the seventy weeks, which had been revealed to him. He was sent to Zecharias, to declare to him the future birth of John the Baptist. Six months after, he was sent to Nazareth to the Virgin Mary, to warn her of the birth of Jesus Christ.

The Orientalists add several particulars to what the Scriptures inform us concerning the angel Gabriel. The Mahometans call him the *faithful spirit;* and the Persians, by way of metaphor, the *peacock of heaven.* We read, in the second chapter of the Koran, that *whosoever is an enemy to Gabriel shall be confounded.* It was Gabriel, they believe, who brought to Mahomet their false prophet the revelations which he published; and it was he who conducted him to heaven mounted upon the animal Borak.

GABRIEL, *St*, an island lying in the great river La Plata, South America, which was discovered by the celebrated navigator Sebastian Cabot, in the year 1526.

GABRIELITES, in ecclesiastical history, a sect of Anabaptists that appeared in Pomerania in 1530. They derive their name from Gabriel Scherling; who, after having been for some time tolerated in that country, was obliged to remove, and died in Poland.

GAD, a Jewish prophet, the seer or domestic prophet of King David, and his adviser in all matters of importance. When the displeasure of the Almighty was roused against David and the children of Israel for numbering the people, Gad received a commission to wait upon the king, and make him an offer of three evils as a punishment for his offence. These were famine, war, or pestilence, the last of which was chosen by David, the ravages of which were terrible beyond description, and produced genuine repentance in the hearts of survivors. To perpetuate the memory of this event, Gad ordered an altar to be erected in the threshing floor of Ornan the Jebusite, around which place, it is said, the temple was afterwards built. We learn from the Old Testament that Gad was an author, who wrote a history of his own times, of which much use appears to have been made by the compilers of the books of Samuel and Chronicles. Gad was also the name of one of the twelve patriarchs, or sons of Jacob.

GAD, in *Ancient Geography*, a district of the Transjordan Palestine, situated between Gilead and the kingdom of Bashan to the north, and the kingdom of the Amorites, to the south; having the Jordan to the west, and bounded by various people on the east; so called from a tribe of that name.

GAD, among miners, a small punch of iron, with a long wooden handle, used to break up the ore.

One of the miners holds this in his hand, directing the point to a proper place, while the other drives it into the vein, by striking it with a sledge hammer.

GAD-Bee, or *Gad-Fly*. See OESTRUS, ENTOMOLOGY *Index*,

GADARA, in *Ancient Geography*, a town of the Peræa, or Transjordan, in the Decapolis, a very strong place. Restored by Pompey after its demolition by the Jews (Josephus). After Herod's death, it was joined to the province of Syria by Augustus.

GADARENORUM AGER, in *Ancient Geography*, the country of the Gadarenes, called by Matthew the country of the Gergesenes, because it was a district that lay between Gadara and Gergesa, otherwise called *Gerasa*, both which lay within the Decapolis on the other side Jordan.

GADES, or GADIRA, in *Ancient Geography*, a small island in the Atlantic, on the Spanish coast, 25 miles from the Columns of Hercules. It was sometimes called *Tartessus* and *Erythia* according to Pliny. Geryon, whom Hercules killed, fixed his residence there. Hercules, surnamed Gaditanus, had there a celebrated temple, in which all his labours were engraved with excellent workmanship. The inhabitants are called Gaditani.

GADUS, a genus of fishes belonging to the order of jugulares. This genus includes the cod, the whiting, the torsk, &c. See ICHTHYOLOGY *Index*.

GAELIC LANGUAGE. See HIGHLANDS.

GÆTULIA, in *Ancient Geography*, a country of Africa, lying to the south of Mauritania, called *Gætulia Propria*, and *Vetus*. *Gætuli*, the people, were distinguished by different epithets; as *Nigri*, *Autololes*, *Daræ* and *Baniuræ*, (Pliny. The *Gætuli* were among the first inhabitants of Africa: a rough, unpolished people, living on venison and the spontaneous productions of the earth; a roving, wandering people, who took up with the first place in which night surprised them, (Sallust).

GAFF, a sort of boom or pole, frequently used in small ships, to extend the upper edge of the mizen; and always employed for the same purpose on those sails whose foremost edges are joined to the mast by hoops or lacings, and which are usually extended by a boom below. Such are the main sails of all sloops, brigs, and schooners.

GAFFAREL, JAMES, a French divine, and very learned writer, born about 1601. He acquired great skill in the oriental and several other languages; and was particularly versant in the cabbalistic and occult sciences, which he learned, exposed, and refuted. Cardinal Richelieu made choice of him for his library keeper, and sent him into Italy to collect the best manuscripts and books. He published a book entitled *Curiositez Innouies*, i.e. Unheard-of Curiosities. It is said the cardinal designed to employ him in his grand project for the reunion of religions. He died in 1681, aged 80. He had been labouring for many years, and had almost finished a history of the subterranean world; containing an account of the caves, grottoes, vaults, catacombs,

catacombs, and mines, he had met with in 30 years travels.

GAGATES, or JET. See JET, MINERALOGY *Index*.

GAGE, in our ancient customs, signifies a pledge or pawn, given by way of security. The word is only properly used in speaking of moveables; for immoveables, *hypotheca* is used.

If the gage perish, the person who received it is not to answer for it, but only for extreme negligence, &c.

GAGE is also used for a challenge to combat: (See CARTEL). In which sense, it was a pledge, which the accuser or challenger cast on the ground, and the other took up as accepting the challenge; it was usually a glove, gauntlet, chaperoon, or the like. See COMBAT, and DUEL.

GAGE, is only now retained as a substantive. As a verb, the *G* is changed into *W*, and of *gage* is formed *wage*: as to wage law, to wage deliverance, q. d. to give security a thing shall be delivered. See WAGE.

If a person who has distrained be sued for not having delivered what he had taken by distress, he should wage, or gage, or gager, deliverance; that is, put in surety that he will deliver them.

Mort-GAGE, is that which is left in the hands of the proprietor, so that he reaps the fruits thereof.

In opposition to *vis-gage*, where the fruits or revenues are reaped by the creditor, and reckoned on the foot of the debt, which diminishes in proportion thereto. The second acquits or discharges itself; the first does not.

GAGE, in the sea language. When one ship is to windward of another, she is said to have the weather-gage of her. They likewise call the number of feet that a vessel sinks in the water, the ship's *gage*; this they find by driving a nail into a pike near the end, and putting it down beside the rudder till the nail catch hold under it; then as many feet as the pike is under water is the ship's gage.

GAGE, among letter founders, a piece of box, or other hard wood, variously notched; the use of which is to adjust the dimensions, slopes, &c. of the different sorts of letters. See FOUNDERY.

GAGE, in joinery, is an instrument made to strike a line truly parallel to the straight side of any board or piece of stuff. Its chief use is for gaging of tenons true, to fit into mortises; and for gaging stuff of an equal thickness. It is made of an oval piece of wood, fitted upon a square stick, to slide up and down stiffly thereon, and with a tooth at the end of a staff, to score, to strike a line upon the staff at any distance, according to the distance of the oval from it.

Sliding GAGE, a tool used by the mathematical instrument makers for measuring and setting off the distances.

Sea GAGE, an instrument invented by Dr Hales and Dr Desaguliers for finding the depth of the sea; the description whereof is this. AB (fig. 1.) is the gage bottle, in which is cemented the gage tube *Ff* in the brass cape at G. The upper end of tube F is hermetically sealed, and the open lower end *f* is immersed in mercury, marked C, on which swims a small thickness or surface of treacle. On the top of the bottle is screwed a tube of brass HG, pierced with several holes to admit the water into the bottle AB. The body K is a weight hanging by its shank L, in a socket N, with a notch on one side at *m*, in which is fixed the catch *l* of the spring S, and passing through the hole, L, in the shank of the weight K, prevents its falling out when once hung on. On the top, in the upper part of the brass tube at H, is fixed a large empty ball, or full blown bladder I, which must not be so large, but that the weight K may be able to sink the whole under water.

The instrument thus constructed is used in the following manner. The weight K being hung on, the gage is let fall into deep water, and sinks to the bottom: the socket N is somewhat longer than the shank L; and therefore, after the weight K comes to the bottom, the gage will continue to descend till the lower part of the socket strikes against the weight; this gives liberty to the catch to fly out of the hole L, and let go the weight K: when this is done, the ball or bladder I instantly buoys up the gage to the top of the water. While the gage is under water, the water having free access to the treacle and mercury in the bottle, will by its pressure force it up into the tube F*f*, and the height to which it has been forced by the greatest pressure, viz. that at the bottom, will be shown by the mark in the tube which the treacle leaves behind it, and which is the only use of the treacle. This shows into what space the whole air in the tube F*f* is compressed; and consequently the height or depth of the water which by its weight produced that compression, which is the thing required.

If the gage tube F*f* be of glass, a scale might be drawn on it with the point of a diamond, showing, by inspection, what height the water stands above the bottom. But the length of 10 inches is not sufficient for fathoming depths at sea, since that, when all the air in such a length of tube is compressed into half an inch, the depth of water is more than 634 feet, which is not half a quarter of a mile.

If, to remedy this, we make use of a tube 50 inches long, which for strength may be a musket barrel, and suppose the air compressed into the hundredth part of half an inch; then by saying, as 1 : 99 :: 400 : 39600 inches, or 3300 feet; even this is but little more than half a mile, or 2640 feet. But since it is reasonable to suppose the cavities of the sea bear some proportion to the mountainous parts of the land, some of which are more than three miles above the earth's surface; therefore, to explore such great depths, the Doctor contrived a new form for the sea gage, or rather for the gage tube in it, as follows. BCDF (fig. 2.) is a hollow metalline globe, communicating on the top with a long tube AB, whose capacity is a ninth part of that globe. On the lower part at D, it has also a short tube DE, to stand in the mercury and treacle. The air contained in the compound gage tube is compressed by the water as before; but the degree of compression, or height to which the treacle has been forced, cannot there be seen through the tube: therefore, to answer that end, a slender rod of metal or wood, with a knob on the top of the tube AB, will receive the mark of the treacle, and show it when taken out.

If the tube AB be 50 inches long, and of such a bore

Gage.

bore that every inch in length should be a cubic inch of air, and the contents of the globe and tube together 500 cubic inches; then when the air is compressed within an hundredth part of the whole, it is evident the treacle will not approach nearer than five inches of the top of the tube, which will agree to the depth of 3300 feet of water as above. Twice this depth will compress the air into half that space nearly, viz. $2\frac{1}{2}$ inches, which correspond to 6600, which is a mile and a quarter. Again, half that space, or $1\frac{1}{4}$ inch, will show double the former depth, viz. 13200 feet, or $2\frac{1}{2}$ miles; which is probably very nearly the greatest depth of the sea.

Bucket Sea GAGE, an instrument contrived by Dr Hales to find the different degrees of coolness and saltness of the sea, at different depths: it consists of a common household pail or bucket, with two heads: These heads have each a round hole in the middle, about four inches in diameter, covered with square valves opening upward; and that they may both open and shut together, there is a small iron rod fixed to the upper part of the lower valve, and the other end to the lower side of the upper valve. So that as the bucket descends with its sinking weight into the sea, both the valves may open by the force of the water, which by that means has a free passage through the bucket. But when the bucket is drawn up, then both the valves shut by the force of the water at the upper part of the bucket; so that the bucket is drawn up full of the lowest sea water to which it has descended. When the bucket is drawn up, the mercurial thermometer fixed in it is examined; but great care must be taken to observe the degree at which the mercury stands, before the lower part of the thermometer is taken out of the water in the bucket, lest it be affected by the different temperature of the air. In order to keep the bucket in a right position, there are four cords fixed to it, reaching about three feet below it; to which the sinking weight is fixed. The result of several trials with this gage was, that when it was let down to different depths, from 360 feet to 5346 feet, in lat. 25. 13. N. and long. 25. 12. W. it was discovered by the thermometer, that the cold increased gradually in proportion to the depths, till it descended to 3900 feet, viz. near $\frac{3}{4}$ths of a mile, whence the mercury in the thermometer came up at 53°; and though it was afterwards sunk to 5346 feet, i. e. a mile and 66 feet, it came up no lower: the warmth of the water upon the surface, and that of the air, was all that time 84°. When the water in the bucket was become of the same temperature with that on the surface of the sea, equal quantities of both were weighed and tried by the hydrometer; that from below was found to be the heaviest, and consequently the saltest.

Dr Hales was probably led to the construction of this sea gage from an instrument invented by Dr Hook, and designed for the same purpose. This consists of a square wooden bucket C, (fig. 3.) whose bottoms are so contrived, that as the weight of A sinks the iron B, to which the bucket C is fastened by two handles D, D, on the end of which are the moveable bottoms or valves EE, and thereby draws down the bucket, the resistance of the water keeps up the bucket in the posture C, whereby the water, whilst the bucket was descending, hath a free passage through it; whereas, as soon as the bucket is pulled upwards by the line F, the resistance of the water to that motion beats the bucket downwards, and keeps it in the posture G, whereby the included water is kept from getting out, and the ambient water kept from getting in. Phil. Trans. N° ix. p. 149. and N° xxiv. p. 447. or Abr. vol. ii. p. 260.

Fig. 3.

Aqueo-mercurial GAGE, is the name of an apparatus contrived by Dr Hales, and applied in various forms to the branches of trees, in order to determine the force with which they imbibe moisture. Let *e r*, (fig. 4.) be a cylindric glass, e. gr. of an inch diameter within, and eight inches long. Into this glass is introduced the branch of a young thriving apple tree *b*, about three feet long, with lateral branches; the diameter of the transverse cut *i* being $\frac{3}{4}$ths of an inch. Having fitted the joint *r* to the tube at *r*, by folding a piece of sheep's skin round the stem, it is cemented with a mixture of bees wax and turpentine melted together, in such proportion as to make a very stiff clammy paste when cold, and over the cement folds of wet bladders are bound firmly with pack thread. To the lower end *e* of the large tube, a smaller tube *z e* is cemented, being about $\frac{1}{4}$ of an inch diameter, and 18 inches long, and in substance full $\frac{1}{6}$ of an inch thick. These tubes are cemented together at *e* with common hard brick dust or powdered chalk cement, and the joint is farther secured with the cement of bees wax and turpentine, over which a wet bladder is bound. The apparatus being thus prepared, the branch is turned downwards, and the glass tube upwards, and then both tubes are filled with water; with the finger applied to the open end of the small tube, it is inverted and immersed in the glass cistern *x*, full of mercury and water. In this situation the lower end of the branch was immersed six inches in water, viz. from *r* to *i*; the water was imbibed by the branch at its transverse cut *i*; and during its ascent into the sap vessels of the branch, the mercury rose in the tube *e z* from the cistern *x*, so that in half an hour it was risen $5\frac{1}{4}$ inches high, as far as *z*. The height of the mercury indicated, in some measure, the force with which the sap was imbibed, though not the whole force; because while the water was imbibed by the branch, its transverse cut was covered with innumerable little hemispheres of air, and many air bubbles issued out of the sap vessels, which partly filled the tube *e r*, as the water was drawn out of it; and therefore the height of the mercury could only be proportionable to the excess of the quantity of water drawn off above the quantity of the air which issued out of the wood. If the quantity of air issuing from the wood had been equal to the quantity of water imbibed, it is plain that the mercury could not rise at all, because there would be no room for it in the tube: but if nine parts in twelve of the water be imbibed by the branch, and only three such parts of air issue into the tube in the same time the mercury must rise near six inches, and so proportionably in other cases. Dr Hales observed, that the mercury rose highest, in most cases, when the sun was clear and warm, and that it subsided three or four inches towards evening, but rose again the next day as it grew warm, though seldom so high as at first. Dr Hales adapted the size and shape of the glass apparatus to a great variety of branches of several sizes and of different kinds of trees, and repeated the experiment above

Gage.

above described, *mutatis mutandis*, in a variety of instances. See his Vegetable Statics, vol. i. chap. ii. p. 84, &c.

Tide GAGE, the name of an instrument used for determining the height of the tides by Mr Bayly, in the course of a voyage towards the south pole, &c. in the Resolution and Adventure, in 1772, 1773, 1774, and 1775. This instrument consists of a glass tube, whose internal diameter was seven-tenths of an inch, lashed fast to a ten-feet fir rod, divided into feet, inches, and quarters: this rod was fastened to a strong post fixed upright and firm in the water. At the lower end of the tube was an exceeding small aperture, through which the water was admitted. In consequence of this construction, the surface of the water in the tube was so little affected by the agitation of the sea, that its height was not altered one-tenth of an inch, when the swell of the sea was two feet; and Mr Bayly was certain, that with this instrument he could discern a difference of one-tenth of an inch in the height of the tide.

Wind GAGE, an instrument for measuring the force of the wind upon any given surface. It was invented by Dr Lind, who gives the following description of it, Phil. Trans. vol. lxv.

This instrument consists of two glass tubes AB, CD, (fig. 5.) of five or six inches in length. Their bores, which are so much the better for being equal, are about four-tenths of an inch in diameter. They are connected together like a siphon, by a small bent glass tube *a b*, the bore of which is about one-tenth of an inch in diameter. On the upper part of the leg AB there is a tube of latten brass, which is kneed, or bent perpendicularly outwards, and has its mouth open towards F. On the other leg CD, is a cover with a round hole G in the upper part of it two-tenths of an inch in diameter. This cover and the kneed tube are connected together by a slip of brass *e d*, which not only gives strength to the whole instrument, but also serves to hold the scale HI. The kneed tube and cover are fixed on with hard cement or sealing wax. To the same tube is soldered a piece of brass *e*, with a round hole in it to receive the steel spindle KL; and at *f* there is just such another piece of brass soldered to the brass hoop *g h*, which surrounds both legs of the instrument. There is a small shoulder on the spindle at *f*, upon which the instrument rests, and a small nut at *i*, to prevent it from being blown off the spindle by the wind. The whole instrument is easily turned round upon the spindle by the wind, so as always to present the mouth of the kneed tube towards it. The end of the spindle has a screw on it; by which it may be screwed into the top of a post or a stand made on purpose. It has also a hole at L, to admit a small lever for screwing it into wood with more readiness and facility. A thin plate of brass *k* is soldered to the kneed tube about half an inch above the round hole G, so as to prevent rain from falling into it. There is likewise a crooked tube AB (fig. 6.) to be put occasionally upon the mouth of the kneed tube F, in order to prevent rain from being blown into the mouth of the wind gage when it is left out all night, or exposed in the time of rain.

The force or momentum of the wind may be ascertained by the assistance of this instrument, by filling the tubes half full of water, and pushing the scale a little up or down till the o of the scale, when the instrument is held up perpendicularly, be on the line with the surface of the water in both legs of the wind-gage. The instrument being thus adjusted, hold it up perpendicularly, and turning the mouth of the kneed tube towards the wind, observe how much the water is depressed by it in the one leg, and raised in the other. The sum of the two is the height of a column of water which the wind is capable of sustaining at that time; and every body that is opposed to that wind will be pressed upon by a force equal to the weight of a column of water, having its base equal to the altitude of the column of water sustained by the wind in the wind gage. Hence the force of the wind upon any body where the surface opposed to it is known may be easily found; and a ready comparison may be made betwixt the strength of one gale of wind and that of another.

The force of the wind may be likewise measured with this instrument, by filling it until the water runs out of the hole G. For if we then hold it up to the wind as before, a quantity of water will be blown out; and if both legs of the instrument are of the same bore, the height of the column sustained will be equal to double the column of water in either leg, or the sum of what is wanting in both legs. But if the legs are of unequal bores, neither of these will give the true height of the column of water which the wind sustained. But the true height may be obtained by the following formulæ.

Suppose that after a gale of wind which had blown the water from A to B (fig. 7.) forcing it at the same time through the other tube out at E, the surface of the water should be found standing at some level DG, and it were required to know what was the height of the column EF or AB, which the wind sustained. In order to obtain this, it is only necessary to find the height of the columns DB or GF, which are constantly equal to one another; for either of these added to one of the equal columns AD, EG, will give the true height of the column of water which the wind sustained.

1. Let the diameters, AC, EH, of the tubes be respectively represented by $c\,d$; and let $a=$AD, or EG, and $x=$DB, or FG: Then it is evident, that the column DB is to the column EG as c^2x to d^2a. But these columns are equal. Therefore $c^2x=d^2a$; and consequently $x=\frac{d^2a}{c^2}$.

2. But if at any instant of time whilst the wind was blowing, it was observed, that, when the water stood at E, the top of the tube out of which it is forced, it was depressed in the other to some given level BF, the altitude at which it would have stood in each, had it immediately subsided, may be found in the following manner: Let $b=$AB or EF.—Then it is evident that the column DB is equal to the difference of columns EF, FG. But the difference of these columns is as d^2b-d^2x; and consequently $x=\frac{d^2b}{c^2+d^2}$.

For the cases when the wind blows in at the narrow leg of the instrument: Let AB$=$EF$=b$, EG or AD$=a$, GF$=$DB$=x$, and the diameters EH, GA, respectively

respectively $=d, c$, as before. Then it is evident, that the column AD is to the column GF as ac^2 to d^2x. But these columns are equal; therefore $d^2x=ac^2$; and consequently $x=\frac{ac^2}{d^2}$. It is also evident that the column AD is equal to the difference of the columns AB, DB; but the difference of these columns is as $bc^2—c^2x$. Therefore $d^2x=bc^2—c^2x$. Whence we get $x=\frac{bc^2}{d^2+c}$.

The use of the small tube of communication ab (fig. 5.) is to check the undulation of the water, so that the height of it may be read off from the scale with ease and certainty. But it is particularly designed to prevent the water from being thrown up to a much greater or less altitude than the true height of the column which the wind is able at that time to sustain, from its receiving a sudden impulse whilst it is vibrating either in its ascent or descent. As in some cases the water in this instrument might be liable to freeze, and thus break the tubes, Dr Lind recommends a saturated solution of sea salt to be used instead of it, which does not freeze till Fahrenheit's thermometer falls to 0.

GAHNIA, a genus of plants belonging to the hexandria class. See BOTANY *Index*.

GAIETA, an ancient, handsome, and strong town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, with a fort, citadel, harbour, and bishop's see. It was taken by the Austrians in 1707, and by the Spaniards in 1734. It is seated at the foot of a mountain near the sea, in E. Long. 13. 37. N. Lat. 41. 30.

GAIN, the profit or lucre a person reaps from his trade, employment, or industry. Some derive the word from the German *gewin:* whereof the Italians had made *guadagno;* the French and English *gain*.

There are legal and reputable gains, as well as sordid and infamous ones. What is gained by gaming is of the latter description. Such gains are not acknowledged by law, so that the payment is not legally binding on the loser.

GAIN, in *Architecture*, is the workman's term for the bevelling shoulder of a joist or other timber. It is used also for the lapping of the end of the joist, &c. upon a trimmer or girder; and then the thickness of the shoulder is cut into the trimmer; also bevelling upwards, that it may just receive the gain; and so the joist and trimmer lie even and level with the surface. This way of working is used in floors and hearths.

To GAIN the Wind, in sea language, is to arrive on the weather side or to windward of some other vessel in sight, when both are plying to windward, or sailing as near the wind as possible.

GAINAGE, GAINAGIUM, in our ancient writers, signifies the draught oxen, horses, wain, plough, and furniture, for carrying on the work of tillage by the baser sort of sokemen and villains.

Gainage is the same with what is otherwise called *wainage*. Bracton, lib. i. cap. 9. speaking of lords and servants, says, *Ut si eos destruant, quod salvum non possit eis esse wainagium suum*. And again, lib. iii. tract. 2. cap. 1. *Villanus non amerciabitur, nisi salvo wainagio suo:* For anciently, as it appears both by Magna Charta, and other books, the villain, when amerced, had his gainage or wainage free, to the end his plough might not stand still; and the law, for the same reason, does still allow a like privilege to the husbandman; that is, his draught horses are not in many cases distrainable.

GAINAGE is also used for the land itself, or the profit raised by cultivating it.

GAINSBOROUGH, a town of Lincolnshire in England, 148 miles from London, seated on the east bank of the Trent, which brings tolerably sized vessels with the tide up to the town, about 40 miles from the Humber. It is a large well built town, with a pretty good trade, is noted for its ale, and has the title of an earldom. W. Long. 1. 45. N. Lat 53. 26. The north marsh in its neighbourhood is noted for horse races. The Danes who invaded the kingdom brought their ships up to this place; and it was here that Sweno the Dane was murdered by one of the English, while revelling with his companions. In the year 1643 a battle was fought here between the royalists and the parliament forces under Cromwell. The number of inhabitants in 1811 amounted to 5172, of whom nearly 600 were employed in trade and manufactures.

GALACTOPHAGI, and GALACTOPOTÆ, in antiquity, persons who lived wholly on milk, without corn or the use of any other food. The words are compounded of γαλα, γαλακτος, *milk;* φαγειν, *to eat;* and ποτης *of* πινω, *I drink*.

Certain nations in Scythia Asiatica, as the Getæ, Nomades, &c. are famous, in ancient history, in quality of *galactophagi*, or milk-eaters. Homer makes their eloge, Iliad, lib. iii.

Ptolemy, in his geography, places the Galactophagi between the Riphæan mountains on one side, and the Hyrcanian sea on the other.

GALANGALS, in the *Materia Medica*. See KÆMPFERIA.

GALANTHUS, the SNOW-DROP, a genus of plants belonging to the hexandria class, and in the natural method ranking under the ninth order, *Spathaceæ*. See BOTANY *Index*.

GALASHIELS, a small town in Selkirkshire in Scotland, situated on the stream called Gala Water, at the place where it joins the Tweed. Galashiels and its neighbourhood have been long famous for the manufacture of coarse woollen cloth, known by the name of *Galashiels grey*. The improved state of the agriculture of this vicinity is much commended. Galashiels is 30 miles S. E. from Edinburgh, and had 986 inhabitants in 1811.

GALATA, a great suburb belonging to Constantinople, opposite to the seraglio, on the other side of the harbour. It is here the Greeks, Armenians, Franks, Christians, and Jews inhabit, and are allowed the exercise of their respective worships.

GALATÆA, or GALATHÆA, in fabulous history, a sea nymph, daughter of Nereus and Doris. She was passionately loved by the Cyclops Polyphemus, whom she treated with coldness and disdain; while Acis, a shepherd of Sicily, enjoyed her unbounded affection. The happiness of these two lovers was disturbed by the jealousy of the Cyclops, who crushed his rival to pieces with a piece of a broken rock while he reposed on the bosom of Galatæa. The nymph was inconsolable for the loss of Acis; and as she could not restore him to life, she changed him into a fountain.

GALATIA, the ancient name of a province of Asia Minor, now called *Amasia*. It was bounded on the

Fig. 3.

BUCKET SEA GAGE.

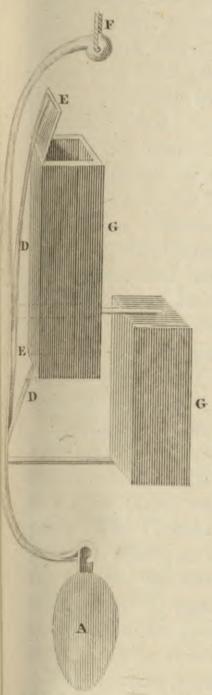


Fig. 1.

SEA GAGE.

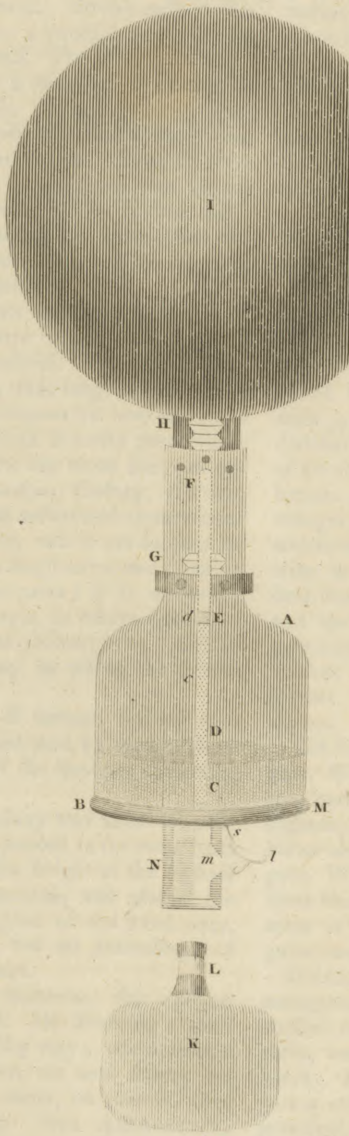


Fig. 2.

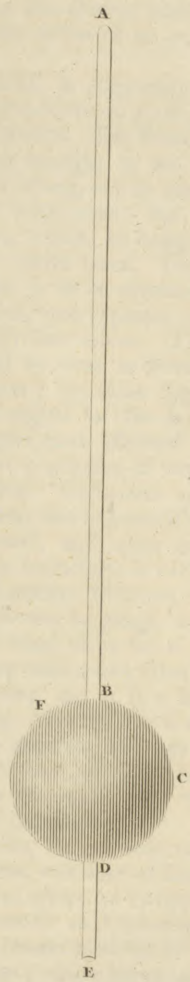


Fig. 5.

WIND GAGE.

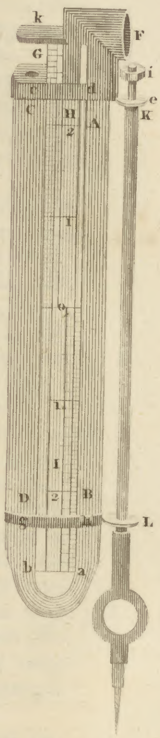
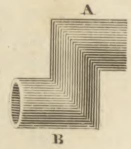


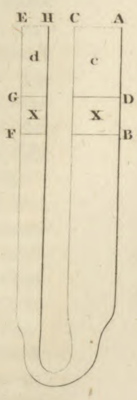
Fig. 6.



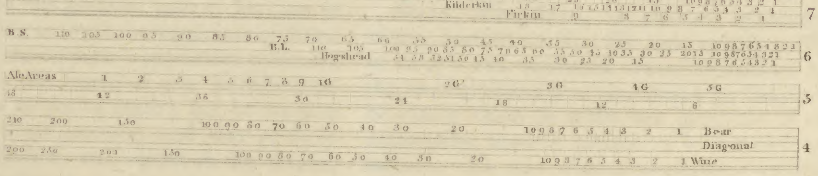
MERCURIAL GAGE.

Fig. 4.

Fig. 7.



FOUR-FOOT GAUGING ROD.



Eng.d by W. & D. Lizars Edin.r

the east by Cappadocia, on the west by Bithynia, on the south by Pamphylia, and on the north by the Euxine sea. It was the north part of Phrygia Magna; but upon being occupied by the Gauls was called *Galatia;* and because situated amidst Greek colonies, and itself mixed with Greeks, *Gallogræcia.* Strabo calls it *Galatia* and *Gallogræcia;* hence a twofold name of the people; *Galatæ* and *Gallogræci.* The Greeks called it *Gallia Parva;* to distinguish it from the *Transalpina*, both which they called *Galatia.* It was reduced under the subjection of the Romans in the time of Augustus, and is now in the hands of the Turks. Here St Paul founded a church, to which he directed that epistle which is still known by the name of the *Epistle to the Galatians*, and was written to reclaim them from the observation of Jewish ordinances, into which they had been seduced by some false teachers.

GALAX, a genus of plants belonging to the pentandria class, and in the natural method ranking with those of which the order is doubtful. See BOTANY.

GALAXY, in *Astronomy*, that long, white, luminous track, which seems to encompass the heavens like a swath, scarf, or girdle: and which is easily perceivable in a clear night, especially when the moon does not appear. The Greeks call it Γαλαξιας, *Galaxy*, of Γαλα, γαλακτος, *Milk;* on account of its colour and appearance: the Latins, for the same reason, call it *via lactea;* or *milky way.* It passes between Sagittarius and Gemini, and divides the sphere into two parts; it is unequally broad; and in some parts is single, in others double.

The ancient poets, and even philosophers, speak of the Galaxy as the road or way by which the heroes went to heaven.

Aristotle makes it a kind of meteor, formed of a crowd of vapours, drawn into that part by certain large stars disposed in the regions of the heavens answering hereto.

Others, finding that the Galaxy was seen all over the globe, that it always corresponded to the same fixed stars, and that it transcended the height of the highest planets, set aside Aristotle's opinion, and placed the Galaxy in the firmament, or region of the fixed stars, and concluded it to be nothing but an assemblage of an infinite number of minute stars.

Since the invention of the telescope, this opinion has been abundantly confirmed. By directing a good telescope to any part of the milky way; where before we only saw a confused whiteness, we now descry an innumerable multitude of little stars, so remote, that a naked eye confounds them. See ASTRONOMY, N° 211.

GALBA, SERGIUS SULPICIUS, a Roman emperor, born the 24th of December, five years before the Christian era. He was gradually raised to the greatest offices of the state, and exercised his power in the provinces with the greatest equity and unremitted diligence. He dedicated the greatest part of his time to solitary pursuits, chiefly to avoid the suspicions of Nero. His disapprobation of the emperor's oppressive command in the provinces was the cause of new disturbances. Nero ordered him to be put to death; but he escaped from the hand of the executioner, and was publicly saluted emperor. When he was seated on the throne, he suffered himself to be governed by favourites, who exposed the goods of the citizens to sale to gratify their avarice. Exemptions were sold at a high price; and the crime of murder was blotted out, and impunity purchased, with a large sum of money. Such irregularities in the emperor's ministers greatly displeased the people; and when Galba refused to pay the soldiers the money which he had promised them when he was raised to the throne, they assassinated him in the 73d year of his age, and the eighth month of his reign. The virtues which had shone so bright in Galba when a private man, totally disappeared when he ascended the throne; and he who showed himself the most impartial judge, forgot the duties of an emperor and of a father of his people.

GALBANUM, in *Pharmacy*, a gum issuing from the stem of an umbelliferous plant growing in Persia and many parts of Africa. See BUBON, BOTANY *Index.*

The juice, as brought to us, is semipellucid, soft, tenacious; of a strong, and to some unpleasant, smell; and a bitterish warm taste: the better sort is in pale coloured masses, which, on being opened, appear composed of clear white tears. Geoffroy relates, that a dark greenish oil is to be obtained from this simple by distillation, which, upon repeated rectifications, becomes of an elegant sky blue colour. The purer sorts of galbanum are said by some to dissolve entirely in wine, vinegar, or water; but these liquors are only partial menstrua with regard to this drug; nor do spirit of wine or oils prove more effectual in this respect: the best dissolvent is a mixture of two parts spirit of wine and one of water. Galbanum agrees in virtue with gum ammoniacum; but is generally accounted less efficacious in asthmas, and more so in hysterical complaints. It is an ingredient in various officinal compositions. See MATERIA MEDICA *Index.*

GALE, in the sea language, a term of various import. When the wind blows not so hard but that a ship may carry her top sails a-trip (that is, hoisted up to the highest), then they say it is a loom gale. When it blows very strong, they say it is a stiff, strong, or fresh gale. When two ships are near one another at sea, and, there being but little wind blowing, one of them finds more of it than the other, they say that the one ship gales away from the other.

GALE, *Dr John*, an eminent and learned minister among the Baptists, was born at London in 1680. He studied at Leyden, where he distinguished himself very early, and afterwards at Amsterdam, under Dr Limborch. He was chosen minister of the Baptist congregation at Barbican; where his preaching, being chiefly practical, was greatly resorted to by people of all persuasions. Four volumes of his sermons were published after his death, which happened in 1721. His Reflections on Dr Wall's History of Infant Baptism is the best defence of the Baptists ever published, and the reading of that performance induced the learned Mr William Whiston and Dr Foster to become Baptists.

GALE, *Theophilus*, an eminent nonconformist minister, born in 1628. He was invited to Winchester in 1657; and continued a stated preacher there until the re-establishment of the church by Charles II. when he rather chose to suffer the penalties of the act of conformity, than to submit to it contrary to his conscience. He was afterwards engaged by Philip Lord Wharton as tutor to his sons, whom he attended to an academy at Caen in Normandy; and when this duty was

was fulfilled, he became pastor over a congregation of private conventiclers in Holborn. He died in 1678; and is principally known by an elaborate work, intitled, the *Court of the Gentiles*, calculated to show that the Pagan philosophers derived their most sublime sentiments from the Scriptures.

GALE, *Dr Thomas*, a learned divine, born at Scruton in Yorkshire, in the year 1636, was educated at Cambridge, and at length became professor of the Greek language in that university. He was afterwards chosen head master of St Paul's school, London; and was employed by the city in writing those elegant inscriptions on the monument erected in memory of the conflagration in 1666. In 1676 he was collated to a prebend in the cathedral of St Paul's; and was likewise elected a fellow of the Royal Society to which he presented a Roman urn with its ashes. About the year 1697, he gave to the new library of Trinity college, in Cambridge, a great number of Arabian manuscripts; and in the same year he was admitted dean of York. He died in that city in 1702; and was interred in the cathedral, where a monument, with a Latin inscription, was erected to his memory. He was a learned divine, a great historian, one of the best Greek scholars of his age, and maintained a correspondence with the most learned men abroad as well as at home. He published, 1. *Historiæ Poeticæ Antiqui Scriptores*, octavo. 2. *Opuscula Mythologica, Ethica, et Physica*, in Greek and Latin, octavo. 3. *Herodoti Historia*, folio. 4. *Historiæ Anglicanæ Scriptores quinque*, in folio. 5. *Historiæ Britannicæ, Saxonicæ, Anglo-Danicæ, Scriptores quindecim*, in folio. 6. *Rhetores Selecti*, &c.

GALEA, in antiquity, a light casque, head piece, or morrion, coming down to the shoulders, and commonly of brass; though Camillus, according to Plutarch, ordered those of his army to be of iron, as being the stronger metal. The lower part of it was called *buccula*, and on the top was a crest. The velites wore a light galea, made of the skin of some wild beast to make it more terrible.

GALEASSE, a large low-built vessel, in which both sails and oars are used, and the largest of all the vessels that make use of the latter. It may carry twenty guns, and has a stern capable of lodging a great number of marines. It has three masts, which are never to be lowered or taken down. It has also thirty-two benches of rowers; and to each bench six or seven slaves, who sit under cover. This vessel is at present used only by the Venetians.

GALEGA, a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

GALEN, CLAUDIUS, in Latin *Galenus*, prince of the Greek physicians after Hippocrates, was born at Pergamus in the Lesser Asia, about the year 131. His father was possessed of a considerable fortune; was well versed in polite literature, philosophy, astronomy, and geometry; and was also well skilled in architecture. He himself instructed his son in the first rudiments of learning, and afterwards procured him the greatest masters of the age in philosophy and eloquence. Galen having finished his studies under their care, chose physic for his profession, and chiefly studied the works of Hippocrates. Having at length exhausted all the sources of literature that were to be found at home, he resolved to travel, in order to converse with the most able physicians in all parts, intending at the same time to take every opportunity of inspecting on the spot the plants and drugs of the countries through which he passed. With this view he went to Alexandria, and staid some years in that metropolis of Egypt; from thence he travelled through Cilicia; passed through Palestine; visited the isles of Crete and Cyprus; and made two voyages to Lemnos, in order to examine the Lemnian earth, which was then esteemed an admirable medicine. With the same view he went into the Lower Syria, in order to obtain a thorough insight into the nature of the opobalsamum, or balm of Gilead; and having completed his design, returned home by the way of Alexandria.

Galen had been four years at Pergamus, where his practice was attended with extraordinary applause, when some seditious commotions induced him to go to Rome, where he resolved to settle: but the proofs he gave of his superior skill, added to the respect shown him by several persons of very high rank, created him so many enemies among his brethren of the faculty, that he was obliged to quit the city, after having resided there four or five years. But he had not long returned to Pergamus, when he was recalled by the emperors Aurelius and Verus. After their death, he retired to his native country; where he died about the year 200. He wrote in Greek; and is said to have composed two hundred volumes, which were unhappily burnt in the temple of Peace. The best editions of those that remain, are, that printed at Basil in 1538, in five volumes, and that of Venice in 1625, in seven volumes. Galen was of a weak and delicate constitution, as he himself asserts; but he nevertheless, by his temperance and skill in physic, arrived at a great age; for it was his maxim, always to rise from table with some degree of appetite. He is justly considered as the greatest physician of antiquity, next to Hippocrates; and he performed such surprising cures, that he was accused of magic.

GALEN, a military township in the state of New-York, situated on the creek of Cauadaque, about 12 miles north-west of Cayuga lake, and 13 south by east of Great Sodus.

GALENA, a name given by mineralogists to a species of lead ore. See LEAD-*Mine*, and MINERALOGY *Index*. It was also the original name given by Andromachus to the theriaca, from its effect in bringing on a pleasing calm over the blood and spirits on taking it.

GALENIA, a genus of plants belonging to the octandria class; and in the natural method ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

GALENIC, or GALENICAL, in *Medicine*, is that manner of considering and treating diseases, founded on the principle of Galen, or introduced by GALEN. This author, collecting and digesting what the physicians before him had done, and explaining every thing according to the strictest doctrine of the Peripatetics, set physic on a new footing: he introduced the doctrine of the four elements; the cardinal qualities and their degrees; and the four humours or temperaments.

GALENIC is more frequently used as contradistinguished from *chemical*.

The distinction of *galenical* and *chemical* was occasioned

sioned by a division of the practitioners of medicine into two sects, which happened on the introduction of chemistry into medicine. Then the chemists, arrogating to themselves every kind of merit and ability, stirred up an opposition to their pretensions, founded on the invariable adherence of the other party to the ancient practice. And though this division into the two sects of galenists and chemists has long since ceased, yet the distinction of medicines which resulted from it is still sometimes observed.

Galenical medicines are those which are formed by the easier preparations of herbs, roots, &c. by infusion, decoction, &c. and by combining and multiplying ingredients; while those of chemistry draw their more intimate and remote virtues by means of fire and elaborate preparations, as calcination, digestion, fermentation, &c.

GALENISTS, a denomination given to such physicians as practise, prescribe, or write, on the galenical principles; and stand opposed to the *chemists*. See GALENICAL. At present the galenists and chemists are pretty well accommodated; and most of our physicians use the preparations and remedies of both.

GALENISTS, or *Galenites*, in church history, a branch of Mennonites or Anabaptists, who take in several of the opinions of the Socinians, or rather Arians, touching the divinity of our Saviour. In 1664 the Waterlandians were divided into two parties, of which the one were called *Galenists*, and the other *Apostolians*. They are thus called from their leader Abr. Galenus, a learned and eloquent physician of Amsterdam, who considered the Christian religion as a system that laid much less stress on faith than practice; and who was for taking into the communion of the Mennonites all those who acknowledged the divine origin of the books of the Old and New Testament, and led holy and virtuous lives.

GALEON. See GALLEON.

GALEOPSIS, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 42d order, *Verticillatæ*. See BOTANY *Index*.

GALERICULUM, was a cap worn both by men and women amongst the ancient Romans. It consisted of skin, which was so neatly dressed with human hair, that the artificial covering could scarcely be distinguished from the natural. It was used by those whose hair was thin; and by wrestlers, to keep their own hair from receiving any injury from the nasty oils with which they were rubbed all over before they exercised. It seems to have resembled our wigs.

GALIANI, FERDINAND, an eminent Italian writer. See SUPPLEMENT.

GALIC or *GAELIC Language*. See HIGHLANDS.

GALICIA, a province of Spain, bounded on the north and west by the ocean, on the south by Portugal, and on the east by Asturias and the kingdom of Leon. The air is temperate along the coast; but, in other places, it is cold and moist. It is but thinly peopled; and the produce is wine, flax, and citrons: the soil is unequal, but affords good pasture. St Jago di Compostella is the capital town.

GALILEE, once a province of Judea, now of Turkey in Asia, was bounded by Mount Lebanon on the north, by the river Jordan and the sea of Galilee on the east, by the Chison on the south, and by the Mediterranean on the west. It was the scene of many of our Saviour's miracles; but the bounds of the country are not now well known, nor yet the places where many of the towns stood.

GALILEANS, a sect of the Jews. Their founder was one Judas a native of Galilee, from which place they derived their name. Their chief, esteeming it an indignity for the Jews to pay tribute to strangers, raised up his countrymen against the edict of the emperor Augustus, which had ordered a taxation or enrolment of all the subjects of the Roman empire.

They pretended that God alone should be owned as Master and Lord, and in other respects were of the opinion of the Pharisees; but, as they judged it unlawful to pray for infidel princes, they separated themselves from the rest of the Jews, and performed their sacrifices apart.

As our Saviour and his apostles were of Galilee, they were suspected to be of the sect of Galileans; and it was on this principle, as St Jerome observes, that the Pharisees laid a snare for him; asking, Whether it was lawful to give tribute to Cæsar; that in case he denied it, they might have an occasion of accusing him.

GALILEO GALILEI, the famous mathematician and astronomer, was the son of a Florentine nobleman, and born in the year 1564. He had from his infancy a strong inclination to philosophy and the mathematics; and made prodigious progress in these sciences. In 1592, he was chosen professor of mathematics at Padua; and during his abode there he *invented*, it is said, the telescope; or, according to others, improved that instrument, so as to make it fit for astronomical observations: (See ASTRONOMY, N° 27.). In 1611, Cosmo II. grand duke of Tuscany, sent for him to Pisa, where he made him professor of mathematics with a handsome salary, and soon after inviting him to Florence, gave him the office and title of *principal philosopher and mathematician to his highness*.

He had been but a few years at Florence, before he was convinced by sad experience, that Aristotle's doctrine, however ill grounded, was held too sacred to be called in question. Having observed some solar spots in 1612, he printed that discovery the following year at Rome; in which, and in some other pieces, he ventured to assert the truth of the Copernican system, and brought several new arguments to confirm it. For these he was cited before the inquisition; and after some months imprisonment, was released upon a simple promise, that he would renounce his heretical opinions, and not defend them by word or writing. But having afterwards, in 1632, published at Florence his "Dialogues of the two greatest systems of the world, the Ptolemaic and Copernican," he was again cited before the inquisition, and committed to the prison of that ecclesiastical court at Rome. In June 22d N. S. that year, the congregation convened: and in his presence pronounced sentence against him and his books, obliging him to abjure his errors in the most solemn manner; committed him to the prison of their office during pleasure; and enjoined him, as a saving penance, for three years to come, to repeat once a-week the seven penitential psalms: reserving to themselves, however, the power of moderating, changing, or taking away altogether or in part, the above-mentioned punish-

 ment

Galileo ‖ Gall.

ment and penance. On this sentence, he was detained a prisoner till 1634; and his "Dialogues of the system of the World" were burnt at Rome.

He lived ten years after this, seven of which were employed in making still further discoveries with his telescope. But by the continual application to that instrument, added to the damage he received in his sight from the nocturnal air, his eyes grew gradually weaker, till he became totally blind in 1639. He bore this calamity with patience and resignation, worthy of a great philosopher. The loss neither broke his spirit, nor hindered the course of his studies. He supplied the defect by constant meditation: whereby he prepared a large quantity of materials, and began to dictate his own conceptions; when, by a distemper of three months continuance, wasting away by degrees, he expired at Arcetti near Florence, in January 1642, N. S. in the 78th year of his age.

Among various useful inventions of which Galileo was the author, is that of the simple pendulum, which he had made use of in his astronomical experiments. He had thought of applying it to clocks; but did not execute it: the glory of that invention was reserved for Vicenzio his son, who made the experiment at Venice in 1649; and M. Huygens afterwards carried this invention to perfection. He wrote a great number of treatises, several of which were published in a collection by Signior Mendessi, under the title of *L'opera di Galileo Galilei Lynceo*. Some of these, with others of his pieces, were translated into English and published by Thomas Salisbury, Esq. in his mathematical collections, &c. in two volumes folio. A volume also of his letters to several learned men, and solutions of several problems, were printed at Bologna in quarto. Besides these, he wrote many others, which were unfortunately lost through his wife's devotion; who, solicited by her confessor, gave him leave to peruse her husband's manuscripts; of which he tore and took away as many as he said were not fit to be published.

GALINACEUS LAPIS. See GALLINACEUS.

GALIUM, a genus of plants belonging to the tetrandia class; and in the natural method ranking under the 47th order, *Stellatæ*. See BOTANY *Index*.

GALL, in the animal economy. See BILE.

Gall was generally given amongst the Jews to persons suffering death under the execution of the law, to make them less sensible of their pain; but gall and myrrh are supposed to have been the same thing; because at our Saviour's crucifixion, St Matthew says, they gave him vinegar to drink mingled with gall; whereas St Mark calls it wine mingled with myrrh. The truth of the matter perhaps is, that they distinguished every thing bitter by the name of gall. The Greeks and Romans also gave such a mixture to persons suffering a death of torture.

A great number of experiments have been made upon the gall of different animals, but few conclusions can be drawn from them with any certainty. Dr Percival, however, hath shown, that putrid bile may be perfectly corrected and sweetened by an admixture of the vegetable acids, vinegar, and juice of lemons. These, he observes, have this effect much more completely than the mineral ones: and hence, he thinks, arises the great usefulness of the vegetable acids in autumnal diseases; which are always attended with a putrescent disposition of the bile, owing to the heat of the preceding summer. On this occasion he takes notice of a common mistake among physicians, who frequently prescribe elixir of vitriol in those diseases where vinegar or lemon juice would be much more effectual.

From this effect of acids on the gall, he also thinks, we may see why the immoderate use of acids is so pernicious to digestion. It is necessary to health that the gall should be in some degree acrid and alkalescent: but as acids have the property of rendering it perfectly mild and sweet, they must be proportionably pernicious to the due concoction and assimilation of the food; which without an acrid bile cannot be accomplished. Hence the body is deprived of its proper nourishment and support, the blood becomes vapid and watery, and a fatal cachexy unavoidably ensues. This hath been the case with many unfortunate persons, who, in order to reduce their excessive corpulency, have indulged themselves in the too free use of vinegar. From the mild state of the gall in young children, Dr Percival also thinks it is, that they are so much troubled with acidities.

GALL-Bladder. See ANATOMY, N° 97.

GALL, in *Natural History*, denotes any protuberance or tumour produced by the puncture of insects on plants and trees of different kinds.

These galls are of various forms and sizes, and no less different with regard to their internal structure. Some have only one cavity, and others a number of small cells communicating with each other. Some of them are as hard as the wood of the tree they grow on, whilst others are soft and spongy; the first being termed *gall nuts*, and the latter *berry galls*, or *apple galls*.

The general history of the gall is this. An insect of the fly kind (the cynips) is instructed by nature to take care for the safety of her young, by lodging her eggs in a woody substance, where they will be defended from all injuries: she for this purpose wounds the leaves or tender branches of a tree; and the lacerated vessels, discharging their contents, soon form tumours about the holes thus made. The external coat of this excrescence is dried by the air; and grows into a figure which bears some resemblance to the bow of an arch, or the roundness of a kernel. This little ball receives its nutriment, growth, and vegetation, as the other parts of the tree, by slow degrees, and is what we call the *gall nut*. The worm that is hatched under this spacious vault, finds in the substance of the ball, which is as yet very tender, a subsistence suitable to its nature; gnaws and digests it till the time comes for its transformation to a nymph, and from that state of existence changes into a fly. After this, the insect, perceiving itself duly provided with all things requisite, disengages itself soon from its confinement, and takes its flight into the open air. The case, however, is not similar with respect to the gall nut that grows in autumn. The cold weather frequently comes on before the worm is transformed into a fly, or before the fly can pierce through its enclosure. The nut falls with the leaves; and although you may imagine that the fly which lies within is lost, yet in reality it is not so; on the contrary, its being covered up so close, is the means of its preservation. Thus it spends the winter in a warm house, where every crack and cranny of the nut is well stopped up; and lies buried as it it were under a heap of leaves, which preserves it from the injuries of the weather. This apartment, however, though so commodious a retreat in the winter, is a perfect prison in the spring. The fly, roused from its lethargy by the first heats, breaks its way through, and ranges where it pleases. A very small aperture is sufficient, since at this time the fly is but a diminutive creature. Besides, the ringlets whereof its body is composed dilate and become pliant in the passage.

Oak galls put, in a very small quantity, into a solution of vitriol in water, though but a very weak one, give it a purple or violet colour: which, as it grows stronger, becomes black; and on this property depends the art of making our writing ink, as also the arts of dyeing and dressing leather, and other manufactures. See INK, CHEMISTRY *Index*.

The best galls come from Aleppo: these are not quite round and smooth like the other sorts, but have several tubercles on the surface. Galls have a very austere styptic taste, without any smell: they are very strong astringents, and as such have been sometimes made use of both internally and externally, but are not much taken notice of by the present practice. Some recommend an ointment of powdered galls and hogs lard as very effectual in certain painful states of hæmorrhois; and it is alleged, that the internal use of galls has cured intermittents after the Peruvian bark has failed. A mixture of galls with a bitter and aromatic has been proposed as a substitute for the bark.

GALL, *St*, a considerable town in Swisserland, and in the Upper Thurgow, with a rich and celebrated abbey, whose abbot is a prince of the empire. This place has for some time been a republic, in alliance with the cantons. It is not very large; but well built, neat, and populous. It contains about 10,000 inhabitants, who are chiefly employed in the linen manufacture; and make annually, it is said, 40,000 pieces of linen, of 200 ells each; which renders it one of the richest towns in Swisserland. The inhabitants are Protestants; for which reason there are often great contests between them and the abbey about religious affairs. It is seated in a narrow barren valley, between two mountains, and upon two small streams. E. Long. 2. 59. N. Lat. 47. 38.

Gall-Fly. See CYNIPS, ENTOMOLOGY *Index*.

GALLA, an Abyssinian nation, originally dwelling, as Mr Bruce supposes, under the line, and exercising the profession of shepherds, which they still continue to do. For a number of years, our author tells us, they have been constantly migrating northwards, though the cause of this migration is not known. At first they had no horses; the reason of which was, that the country they came from did not allow these animals to breed: but as they proceeded northward and conquered some of the Abyssinian provinces, they soon furnished themselves with such numbers, that they are now almost entirely cavalry, making little account of infantry in their armies. On advancing to the frontiers of Abyssinia, the multitude divided, and part directed their course towards the Indian ocean; after which, having made a settlement in the eastern part of the continent, they turned southward into the countries of Bali and Dawaw, which they entirely conquered, and settled there in the year 1537. Another division having taken a westerly course, spread themselves in a semicircle along the banks of the Nile; surrounding the country of Gojam, and passing eastward behind the country of the Agows, extended their possessions as far as the territories of the Gongas and Gafats. Since that time the Nile has been the boundary of their possessions; though they have very frequently plundered, and sometimes conquered, the Abyssinian provinces on the other side of the river, but have never made any permanent settlement in these parts. A third division has settled to the southward of the low country of Shoa, which the governor of that province has permitted, in order to form a barrier betwixt him and the territories of the emperor, on whom he scarcely acknowledges any dependence.

The Galla are of a brown complexion, and have long black hair; but some of them who live in the valleys are entirely black. At first their common food was milk and butter; but since their intercourse with the Abyssinians, they have learned to plough and sow their land, and to make bread. They seem to have predilection for the number seven, and each of the three divisions already mentioned is subdivided into seven tribes. In behaviour they are extremely barbarous; and live in continual war with the Abyssinians, whom they murder without mercy as often as they fall into their hands. They cut off the privities of the men, and hang them up in their houses by way of trophies; and are so cruel as to rip up women with child, in hopes of thus destroying a male. Yet notwithstanding their excessive cruelty abroad, they live under the strictest discipline at home; and every broil or quarrel is instantly punished according to the nature of the offence. Each of the three divisions of the Galla above mentioned has a king of its own; and they also have a kind of nobility, from among whom the sovereign can only be chosen: however, the commonalty are not excluded from rising to the rank of nobles if they distinguish themselves very much in battle. None of the nobility can be elected till upwards of 40 years of age, unless he has with his own hand killed a number of enemies which added to his own age makes up 40. There is a council of each of the seven tribes, which meets separately in its own district, to settle how many are to be left behind for the governing and cultivating of the territory, and other matters of importance. These nations have all a great veneration for a tree which grows plentifully in their country, called *wanzey*, and which these superstitious people are even said to adore as a god. Their assemblies for the choice of a king are all held under one of these trees; and when the sovereign is chosen, they put a bludgeon of this wood in his hand by way of sceptre, and a garland of the flowers upon his head.

The Galla are reported to be very good soldiers, especially in cases of surprise; but, like most other barbarians, have no constancy nor perseverance after the first attack. They will, however, perform extraordinary marches, swimming rivers holding by the horse's tail, and thus being enabled to do very great mischief by reason of the rapidity of their movements. They are excellent light horse for a regular army in a hostile country; but are very indifferently armed, on account of the scarcity of iron among them. Their principal arms are lances made of wood sharpened at the end and hardened in the fire; and their shields are composed only of one single fold of bull's hide; so that they are extremely apt to warp by heat, or become too soft

soft in wet weather. They are exceedingly cruel; and make a shrill horrid noise at the beginning of every engagement, which greatly terrifies the horses, and very often the barbarous riders which oppose them.

The Galla, according to Mr Bruce's account, are somewhat below the middle size, but extremely light and nimble. The women are fruitful; and suffer so little in childbearing, that they do not even confine themselves for a single day after delivery. They plough, sow, and reap the corn, which is trodden out by the cattle; but the men have all the charge of the cattle in the fields. In their customs they are filthy to the last degree; plaiting their hair with the guts of oxen, which they likewise twist round their middle, and which by the quick putrefaction occasion an abominable stench. They anoint their heads and whole bodies with butter or grease; in which, as well as in other respects, they greatly resemble the Hottentots. It has been supposed that they have no religion whatever; but Mr Bruce is of opinion that this is a mistake. The wanzey, he says, is undoubtedly worshipped by all the nations as a god; and they have likewise certain stones which are worshipped as gods: besides these, they worship the moon, and some stars, when in certain positions, and at some particular seasons of the year. They all believe in a resurrection; and have some faint notions of a state of happiness, but no idea of future punishment. Some of them to the southward profess the Mahometan religion, but those to the east and west are generally Pagans. All of them intermarry with each other; but will not allow strangers to live among them, though the Moors have at last found out a method of trading safely with them. The commodities they deal in are blue Surat cloths, myrrh, and salt; the last being the most valuable article.

The marriages among the Galla are celebrated with some of the disgusting customs of the Hottentots; and after these ceremonies the bridegroom promises to give the bride meat and drink while she lives, and to bury her when dead. Polygamy is allowed among them; but it is singular, that among these people the women solicit their husbands to take others to their embraces. The reason of this custom is, that the men may have numerous families of children, who may be capable of defending them against their enemies; as the Galla, according to our author, always fight in families, whether against foreign enemies or with one another.

GALLAND, Anthony, a learned antiquarian, member of the Academy of Inscriptions, and professor of Arabic in the Royal College of Paris, was born of poor parents at Rollo, a village in Picardy. Having studied at the Sorbonne and other universities, he travelled into the east; where he acquired great skill in the Arabic tongue, and in the manners of the Mahometans. He wrote several works; the principal of which are, 1. An account of the Death of the Sultan Osman, and the Coronation of the Sultan Mustapha. 2. A Collection of Maxims, drawn from the works of the Orientals. 3. A Treatise on the Origin of Coffee. 4. The Arabian Nights Entertainments, &c.

GALLANT, or Galant, a French term adopted into our language, and signifying polite, civil, and well bred, with a disposition to please, particularly the ladies. It also signifies brave or courageous.

GALLE, the name of several engravers, of whom the principal was Cornelius, who flourished about the 1600. He learned the art of engraving from his father, and imitated his stiff stile, till he went to Rome, where he resided a considerable time, and there acquired that freedom, taste, and correctness of drawing, which are found in his best works. He settled at Antwerp upon his return from Italy, where he carried on a considerable commerce in prints. His best prints are those done after Rubens.

GALLEON, in naval affairs, a sort of ships employed in the commerce of the West Indies. The Spaniards send annually two fleets; the one for Mexico, which they call the *flota*; and the other for Peru, which they call the *galleons*. See Flota.

By a general regulation made in Spain, it has been established, that there should be twelve men of war and five tenders annually fitted out for the armada or galleons; eight ships of 600 tons burden each, and three tenders, one of 100 tons, for the island Margarita, and two of 80 each, to follow the armada; for the New Spain fleet, two ships of 600 tons each, and two tenders of 80 each; and for the Honduras fleet, two ships of 500 tons each: and in case no fleet happened to sail any year, three galleons and a tender should be sent to New Spain for the plate.

They are appointed to sail from Cadiz in January, that they may arrive at Porto Bello about the middle of April; where, the fair being over, they may take aboard the plate, and be at Havannah with it about the middle of June; where they are joined by the flota that they may return to Spain with the greater safety.

GALLEOT, a small galley designed only for chase, carrying but one mast and two pattereroes; it can both sail and row, and has 16 or 20 oars. All the seamen on board are soldiers, and each has a musket by him on quitting his oar.

GALLERIES, in *Gardening*, are certain ornaments made with trees of different kinds; which are very common in all the French gardens, but are seldom introduced into the British ones, especially since the taste for clipped trees has been exploded. For those, however, who may still choose to have them, Mr Miller gives the following directions.

In order to make a gallery in a garden with porticoes and arches, a line must first be drawn of the length you design the gallery to be; which being done, it is to be planted with hornbeam, as the foundation of the gallery. The management of galleries is not difficult. They require only to be digged round about; and sheered a little when there is occasion. The chief curiosity required is in the ordering the fore part of the gallery, and in forming the arches. Each pillar of the porticoes or arches ought to be four feet distant from another, and the gallery 12 feet high and 10 feet wide, that there may be room for two or three persons to walk abreast. When the hornbeams are grown to the height of three feet, the distance of the pillars well regulated, and the ground work of the gallery finished, the next thing to be done is to form the frontispiece; to perform which, you must stop the hornbeam between two pillars for that purpose, which forms the arch. As it grows, you must with your sheers cut off those boughs which outshoot the others. In time they will grow strong, and may be kept in form by the sheers. Portico galleries may be covered with lime trees.

GALLERY, in *Architecture*, a covered place in a house, much longer than broad, and usually in the wings of a building, its use being chiefly to walk in.

GALLERY, in *Fortification*, a covered walk across the ditch of a town, made of strong beams covered over with planks, and loaded with earth: sometimes it is covered with raw hides, to defend it from the artificial fires of the besieged.

GALLERY of a Mine, is a narrow passage or branch of a mine carried on under ground to a work designed to be blown up. See MINE.

GALLERY, in a ship, that beautiful frame, which is made in the form of a balcony, at the stern of a ship without board; into which there is a passage out of the admiral's or captain's cabin, and is for the ornament of the ship.

GALLEY, a kind of low flat-built vessel, furnished with one deck, and navigated with sails and oars, particularly in the Mediterranean. By the Greek authors under the eastern empire, this kind of vessel was called γαλαια and γαλεια; and by the Latin authors of the same time, *galea;* whence, according to some, the modern denomination. Some say it was called *galea*, on account of a casque or helmet which is carried on its prow, as Ovid attests, *de Tristibus*. The French call it *galere;* by reason, they say, that the top of the mast is usually cut in the form of a hat, which the Italians call *galero*. Others derive both *galea*, and *galere*, from a fish by the Greeks called γαλεωτης or ξιφιας, and by us the *sword-fish*, which this vessel resembles. Lastly, Others derive the *galley*, *galea*, *galere*, *galeasse*, &c. from the Syriac and Chaldee *gaul*, and *galin*, a man exposed on the water in a vessel of wood.

The largest sort of these vessels is employed only by the Venetians. They are commonly 162 feet long above, and 133 feet by the keel; 32 feet wide, with 23 feet length of stern post. They are furnished with three masts, and 32 banks of oars; every bank containing two oars, and every oar being managed by six or seven slaves, who are usually chained thereto. In the fore part they have three little batteries of cannon, of which the lowest is of two 36 pounders, the second of two 24 pounders, and the uppermost of two 2 pounders: three 18 pounders are also planted on each quarter. The complement of men for one of these galleys is 1000 or 1200. They are esteemed extremely convenient for bombarding or making a descent upon an enemy's coast, as drawing but little water; and having by their oars frequently the advantage of a ship of war, in light winds or calms, by cannonading the latter near the surface of the water; by scouring her whole length with their shot, and at the same time keeping on her quarter or bow, so as to be out of the direction of her cannon.

The galleys next in size to these, which are also called *half galleys*, are from 120 to 130 feet long, 18 feet broad, and nine or ten feet deep. They have two masts which may be struck at pleasure; and are furnished with two large lateen sails, and five pieces of cannon. They have commonly 25 banks of oars, as described above. A size still less than these are called *quarter galleys*, carrying from 12 to 16 banks of oars. There are very few galleys now besides those in the Mediterranean, which are found by experience to be of little utility except in fine weather; a circumstance which renders their service extremely precarious. They generally keep close under the shore, but sometimes venture out to sea to perform a summer cruise.

GALLEY-Worm, in *Zoology*. See IULUS, ENTOMOLOGY *Index*.

GALLI, in antiquity, a name given to the priests of Cybele, from the river Gallus in Phrygia; but of the etymology of the name we have no certain account. All that we learn with certainty about them is, that they were eunuchs and Phrygians, and that in their solemn processions they danced, bawled, drummed, cut and slashed themselves, played upon timbrels, pipes, cymbals, &c. and driving about an ass loaded with the sacred rites and trumpery of their goddess. When a young man was to be initiated, he was to throw off his clothes, run crying aloud into the midst of their troop, and there draw a sword and castrate himself; after this he was to run into the street with the parts cut off, in his hand, throw them into some house, and in the same house put on a woman's dress.

These priests had the names also of *Curetes*, *Corybantes*, and *Dactyli*. The chief priest was called *Archi-Gallus*. This order of priesthood is found both amongst the Greeks and Romans. See an account of them in *Lucret.* lib. ii. and *Juv.* Sat. vi.

GALLI, the *Gauls*. See GALLIA and GAULS.

GALLI, five small desolate islands on the coast of the Principato Citra of Naples. They are supposed to be the Syrenusæ, or islands once inhabited by the Sirens, which Ulysses passed with so much caution and hazard. Great revolutions, however, have been occasioned in their shape, size, and number, by the effects of subterranean fire; and some learned persons go so far as to assert, that these rocks have risen from the bottom of the sea since Homer sang his rhapsodies; consequently, that those monsters dwelt on some other spot, probably Sicily or Capri. The tradition of Sirens residing hereabouts is very ancient and universally admitted; but what they really were, divested of their fabulous and poetical disguise, it is not easy to discover. See SIREN.

The Sirenusæ were only three in number; and therefore if these and the Galli be the same, two more must have since risen, or the three have been split into five by a subterraneous convulsion. On the largest is a watch-tower, and the next has a deserted hermitage. The principal island is only a narrow semicircular ridge covered with a shallow coat of soil; two other little islands and some jagged rocks just peeping above the waves, correspond with this one so as to trace the outline of a volcanical crater. The composition of them all is at top a calcareous rock, extremely shaken, tumbled, and confused, mixed with masses of breccia, disposed in a most irregular manner; below these is lava, and the deeper the eye follows it the stronger are the marks of fire: below the surface of the water, and in some places above it, the layers are complete blocks of basaltes. Hence it is presumed by some that central fires have heaved up to light the torrefied substances that originally lay near their focus, with all the intermediate strata that covered them from the sea. The layers incline downwards from east to west; the air seems to have forced its way into part of the mass while in fusion, and by checking its workings caused many large caverns.

caverns to be left in it. These islands are uncultivated and uninhabited since the old hermit of St Antonio died. Myrtle covers most of the surface.

GALLIA, a large country of Europe, called *Galatia* by the Greeks. The inhabitants were called *Galli*, *Celtæ*, *Celtiberi*, and *Celtoscythæ*. Ancient Gaul was divided into four different parts by the Romans, called *Gallia Belgica*, *Narbonensis*, *Aquitania*, and *Celtica*. Gallia Belgica was the largest province, bounded by Germany, Gallia Narbonensis, and the German ocean; and containing the modern county of Alsace, Lorraine, Picardy, with part of the Low Countries, and of Champagne, and of the Isle of France. Gallia Narbonensis, which contained the provinces now called *Languedoc*, *Provence*, *Dauphiné*, *Savoy*, was bounded by the Alps and Pyrenean mountains, by Aquitania, Belgium, and the Mediterranean. Aquitania Gallia, now called the *provinces of Poitou*, *Santonge*, *Guienne*, *Berry*, *Limosin*, *Gascogny*, *Auvergne*, &c. was situated between the Garumna, the Pyrenean mountains, and the ocean. Gallia Celtica, or Lugdunensis, was bounded by Belgium, Gallia Narbonensis, the Alps, and the ocean. It contained the country at present known by the names of *Lyonnois*, *Touraine*, *Franche Compté*, *Senenois*, *Switzerland*, and part of *Normandy*. Besides these grand divisions, there is often mention made of Gallia Cisalpina or Citerior, Transalpina or Ulterior, which refers to that part of Italy which was conquered by some of the Gauls who crossed the Alps. By Gallia Cisalpina, the Romans understood that part of Gaul which lies in Italy, and by Transalpina, that which lies beyond the Alps, in regard only to the inhabitants of Rome. Gallia Cispadana, and Transpadana, is applied to a part of Italy conquered by some of the Gauls; and then it means the country on this side of the Po, or beyond the Po, with respect to Rome. By Gallia Togata, the Romans understood Cisalpine Gaul, where the Roman gowns, *togæ*, were usually worn. Gallia Narbonensis was called *Braccata*, on account of the peculiar covering of the inhabitants for their thighs. The epithet of *Comata* is applied to Gallia Celtica, because the people suffered their hair to grow to an uncommon length. The inhabitants were great warriors, and their valour overcame the Roman armies, took the city of Rome, and invaded Greece in different ages. They spread themselves over the greatest part of the world. They were very superstitious in their religious ceremonies, and revered the sacerdotal order as if they had been gods. They long maintained a bloody war against the Romans, and Cæsar resided ten years in their country before he could totally subdue them. See GAUL.

GALLIARD, or GAGLIARDA, a sort of dance anciently in great request; consisting of very different motions and actions, sometimes proceeding *terra à terra* or smoothly along; sometimes capering; sometimes along the room, and sometimes across. The word is French, *galliarde*, or rather Italian; and literally signifies, gay, merry, sprightly." This dance was also called *Romanesque*, because brought from Rome.

Thoinot Arbeau, in his Orchesography, describes it as consisting of five steps, and five positions of the feet, which the dancers performed before each other, and whereof he gives us the score or tablature, which is of six minims, and two triple times.

GALLIARDA, in the Italian music, the name of a tune that belongs to a dance called a *Galliard*. The air of it is lively and in triple time.

GALLIC ACID. See CHEMISTRY *Index*.

GALLICAN, any thing belonging to France; thus the term *Gallican church* denotes the church of France, or the assembly of the clergy of that kingdom.

GALLICISM, a mode of speech peculiar to the French language, and contrary to the rules of grammar in other languages. With us it is used to denote such phrases or modes of speech in English as are formed after the French idiom.

GALLINACEUS LAPIS, a glossy mineral substance supposed by some to be produced by the operation of volcanic fires; and is thought to be the *lapis obsidianus* of the ancients. See OBSIDIAN, MINERALOGY *Index*.

GALLINÆ, an order of birds. See ORNITHOLOGY *Index*.

GALLINACEOUS, an appellation given to the birds of the order of the gallinæ.

GALLING, or EXCORIATION, in *Medicine*. See EXCORIATION.

GALLING *of a Horse's Back*, a disorder occasioned by heat, and the chafing or pinching of the saddle.

In order to prevent it, some take a hind's skin well garnished with hair, and fit it neatly under the pannel of the saddle, so that the hairy side may be next the horse.

When a horse's back is galled upon a journey, take out a little of the stuffing of the pannel over the swelling, and sew a piece of soft white leather on the inside of the pannel: anoint the part with salt butter, and every evening wipe it clean, rubbing it till it grow soft, anointing it with salt butter, or, for want of that with grease: wash the swelling, or hurt, every evening with cold water and soap; and strew it with salt, which should be left on till the horse be saddled in the morning.

GALLINULE. See FULICA, ORNITHOLOGY *Index*.

GALLIPOLI, a sea-port town of Italy, in the kingdom of Naples, and in the Terra-di-Otranto, with a bishop's see. It stands on a rocky island, joined to the continent by a bridge. From the remotest antiquity this was a station so favourable to commerce, that every maritime power wished to secure it; and it is a reproach to government, that nothing has been done to improve its natural advantages: at present, Mr Swinburne informs us, it has neither harbour nor shelter for shipping. Charles II. demolished Gallipoli for its adherence to Frederick of Arragon. The Venetians treated it with great cruelty in the 15th century: and in 1481 it was pillaged by the Turks. To preserve it from future calamities, Charles V. repaired and strengthened its fortifications; and, since that period, it has enjoyed the benefits of peace and trade, which have rendered it the most opulent and gayest town upon the coast, though its inhabitants do not exceed 9000 in number. Consumptions and spitting of blood are rather frequent here, occasioned by the great subtility of the air, which is ventilated from every quarter. The buildings are tolerable, and some of of the churches have good paintings. The cotton trade brings in about 30,000 ducats a-year. Good muslins, cotton stockings, and other parts of apparel, are manufactured here, and purchased by the Provençals; for Gallipoli has no direct trade with the metropolis. Silk and saffron were formerly objects of traffic; but heavy duties and oppression have caused them to be abandoned. The wine of this territory is good; but from dryness of climate, and shallowness of soil, the vintage frequently fails in quantity; and then the Gallipolitans have recourse to Sicily for a supply. Oil is the great support of the place: two thirds of the produce of its olive plantations are exported to France, and the north of Italy; the remainder is sent to Naples, and other ports of the kingdom. Neapolitan merchants, by means of agents settled at Gallipoli, buy up the oils, from year to year, long before an olive appears upon the tree; and the price is afterwards settled by public authority. The Neapolitans sell their oil to the merchants of Leghorn; and, if faithfully served by their factors in Terra di Otranto, ought to double their capital in two years. But, to balance this advantage, they run great risks, pay exorbitant interest, and have frequent bankruptcies to guard against. E. Long. 15. 28. N. Lat. 40. 29.

GALLIPOLI, a sea-port town of Turkey in Europe, in the province of Romania, seated at the mouth of the sea of Marmora, with a good harbour and a bishop's see. It contains about 10,000 Turks, and 7000 Greeks and Jews. The bazar or bezestein, the place where merchandises are sold, is a handsome structure, with domes covered with lead. It is an open place, and has no other defence than a paltry square castle. The houses of the Greeks and Jews have doors not above three feet and a half high, to prevent the Turks riding into their houses. E. Long. 26. 44. N. Lat. 40. 24.

GALLIUM. See GALIUM, BOTANY *Index*.

GALLO, an island of the South sea, near the sea-coast of Peru, in South America, which was the first place possessed by the Spaniards when they attempted the conquest of Peru; it is also the place where the bucaniers used to come for wood and water, and to refit their vessels when they were in these parts. W. Long. 88. 0. N. Lat. 2. 30.

GALLO-Græcia, a country of Asia Minor, near Bithynia and Cappadocia. It was inhabited by a colony of Gauls, who assumed the name of *Gallogræci* because a number of Greeks had accompanied them in their emigration. See GALATIA.

GALLOIS, JOHN, born at Paris in 1632, was an universal scholar, but chiefly noted for having been, in conjunction with M. de Sallo who formed the plan, the first publisher of the *Journal des Sçavans*. The first journal was published January 5. 1665; but these gentlemen criticised new works so rigorously, that the whole tribe of authors united and cried it down. De Sallo declined entirely after the publication of the third number: but Gallois ventured to send out a fourth, on January 4. 1666; though not without a most humble advertisement at the beginning, wherein it was declared, that the author "would not presume to criticise, but simply give an account of the books." This, with the protection of M. Colbert, who was greatly taken with the work, gradually reconciled the public to it: and thus began literary journals, which have been continued from that time to this, under various titles, and by various writers. Gallois continued his journal to the year 1674, when more important occupations obliged him to turn it over to other hands. M. Colbert had taken him into his house to teach him Latin; and when he lost his patron in 1683, he was first made librarian to the king, and then Greek professor in the royal college. He died in 1707.

GALLON, a measure of capacity both for dry and liquid things, containing four quarts. But these quarts, and consequently the gallon itself, are different, according to the quality of the things measured: For instance, the wine gallon contains 231 cubic inches, and holds eight pounds avoirdupois of pure water; the beer and ale gallon contains 282 solid inches, and holds ten pounds three ounces and a quarter avoirdupois of water; and the gallon for corn, meal, &c. 272$\frac{1}{4}$ cubic inches, and holds nine pounds thirteen ounces of pure water.

GALLOP, in the manege, is the swiftest natural pace of a horse, performed by reaches or leaps; the two fore feet being raised almost at the same time; and when these are in the air, and just ready to touch the ground again, the two hind feet are lifted almost at once. The word is borrowed from the barbarous Latin *calupare*, or *calparc*, "to run." Some derive it from *caballicare*; others from the Greek καλπαζειν, *to spur a horse.*

GALLOPER, in artillery, is the name of a carriage which serves for a pound and a half gun. This carriage has shafts so as to be drawn without a limber, and is thought by some to be more convenient and preferable to other field carriages; and it may likewise serve for our light three and six pounders.

GALLOWAY, a county of Scotland, which gives the title of Earl to a branch of the noble family of Stuart. It is divided into two districts; the western, called *Upper Galloway*, being the same with Wigtonshire; and the eastern, or stewartry of Kirkcudbright, called *Lower Galloway*. See KIRKCUDBRIGHT and WIGTONSHIRE.

MULL of Galloway, the most southerly cape or promontory of Scotland, in the county of Galloway, and on the Irish sea.

GALLOWAYS is the name of a peculiar sort of horses, so called from the county of Galloway in Scotland, where they are bred. Tradition reports that this kind of horses sprang from some Spanish stallions, which swam on shore from some of the ships of the famous Spanish armada, wrecked on the coast; and coupling with the mares of the country, furnished the kingdom with their posterity. They were much esteemed, and of a middling size, strong, active, nervous, and hardy.

GALLOWS, an instrument of punishment, whereon persons convicted capitally of felony, &c. are executed by hanging.

Among our ancestors it was called *furca*, "fork;" a name by which it is still denominated abroad, particularly in France and Italy. In this latter country, the reason of the name still subsists; the gallows being a real fork driven into the ground, across the legs whereof

whereof is laid a beam, to which the rope is tied. See FURCA.

GALLUS, CORNELIUS, an ancient Roman poet, born at Forum Julium, now called *Frejus* in France. He was a particular favourite with Augustus Cæsar, who made him governor of Egypt: but his maladministration there occasioned his banishment, and the loss of his estate; for grief of which he put an end to his own life. He wrote four books of love elegies; and Virgil has complimented him in many places.

GALLUS, or *Cock*. See PHASIANUS, ORNITHOLOGY *Index*.

GALLY, in printing, a frame into which the compositor empties the lines out of his composing-stick, and in which he ties up the page when it is completed.

The gally is formed of an oblong square board, with a ledge on three sides, and a groove to admit a false bottom called a *gally slice*.

GALVANI, LEWIS, was born at Bologna in Italy, in the year 1737. There many of his relations had arrived at distinguished eminence in jurisprudence and divinity, and he himself had the honour of giving his name to a supposed new principle in nature, which of consequence is called *Galvanism*, although this great man gave it the name of *animal electricity*. From a boy he became enamoured of the greatest austerities of the Catholic religion, and joined himself to a convent, the monks of which were celebrated for their attachment to the solemn duty of visiting the dying. He wished much to become a member of this order, but was prevailed on to relinquish the idea by one of the brotherhood, after which he turned his whole attention to the study of medicine in its various branches. He studied under Beccari, Tacconi, Galli, and in a particular manner Galleazzi, who took him into his own house; and he afterwards became his son-in-law. He acquired great reputation by his inaugural thesis, *De Ossibus*, in 1762, and was soon after chosen public lecturer in the university of Bologna, and reader in anatomy to the institute of that city. So much admired was his talent for lecturing, that vast numbers constantly attended him; and he employed his few leisure hours in making experiments, and in the useful study of comparative anatomy. We find in the Memoirs of the Institute of Bologna, a number of curious observations on the urinary organs, and on the organs of hearing in birds.

Soon after his anatomical and physiological knowledge was fully established throughout the Italian schools, a mere accident led him to that interesting discovery which will transmit his name with honour to the latest posterity. His amiable wife, for whom he cherished the most ardent love, and with whom he had been united for a number of years, was in a declining state of health, and was using a soup of frogs by way of restorative. Some of these animals being skinned for this purpose, were lying on a table in Galvani's laboratory, where also stood an electrical machine. One of those who assisted him in conducting his experiments, unintentionally brought the point of a scapel near the crural nerves of a frog which lay near the conductor, when the muscles of the limb were very strongly convulsed. Madame Galvani, who was a woman of a penetrating understanding, and a lover of science, happened to witness the phenomena, of which she instantly informed her husband. On his arrival he repeated the experiment, and discovered that the convulsions only happened when the scapel was in contact with the nerve, and a spark was drawn from the conductor at the same time. After an almost endless variety of experiments, conducted with great ingenuity, which it would be foreign to the design of this article to enumerate here, he concluded that all animals have within them an electricity of a peculiar nature; that this fluid is contained in most parts, but is most apparent in the nerves and muscles; that it is secreted by the brain, and diffused by the nerves through various parts of the body.

He compared each muscular fibre to a small Leyden phial, and attempted to explain the phenomena of muscular motion by analogies taken from that instrument. He first thought of its pathological influence in regard to rheumatic, convulsive, paralytic, and other nervous affections. His first publication on this grand discovery was entitled *Aloysii Galvani de viribus Electricitatis in Motu Musculari Commentarius*, which made its appearance in 4to, in the year 1791, and was printed for the Institute of Bologna. By this work the attention of philosophers both in Italy and other countries was instantly roused, and it was soon followed by numerous publications, in some of which the sentiments of Galvani were defended, and in others they were opposed. The celebrated Volta turned his attention to the subject, and adduced a number of arguments to prove that Galvani's opinion respecting animal electricity was erroneous, deriving the phenomena from the electric matter of the atmosphere, and allowing the nerves and muscles no higher place than that of the most sensible tests hitherto discovered. The doctrine of Volta received many admirers and advocates; yet there are still numbers to be met with in the learned world who support the sentiments of Galvani, who still adhere to his original theory, in the defence of which he displayed much candour and modesty, as well as ingenuity, by which he may be justly considered as deserving that distinguished place among the experimental philosophers, which the union of his name with the most interesting natural phenomena will probably secure to him for ever. See GALVANISM.

These important inquiries, joined to the duties of his office as a professor, and his extensive practice in the capacity of surgeon and man-midwife (*accoucheur*), in both which he eminently excelled, afforded abundant scope for his indefatigable industry. He composed a variety of memoirs on topics connected with his profession; but these, as far as we know, have never been published. He delighted to converse with men of science, in whose company new publications were read, and their merits investigated, which was certainly a valuable source of intellectual improvement.

The character of Galvani in private life is allowed to have been most amiable; and his sensibility, which was naturally strong, received a violent shock in the death of his amiable wife, in the year 1790. This event brought upon him the most alarming melancholy, which he even delighted to encourage, by visiting her tomb in the nunnery of St Catharine, and pouring forth his unavailing lamentations over her grave. He was ever punctual in the discharge of the duties of his religion, even

Galvani.

even to the minutest rite, as he never lost the pious impressions which were made upon his mind at an early period of life. To this cause we may probably trace back his determination never to take what was called the civic oath of allegiance to the Cisalpine republic, for which he was barbarously deprived of all his offices and dignities. Devoured by melancholy, and nearly reduced to a state of indigence, he took up his residence in the house of his brother James, a man of respectability, where he fell into a state of extenuation and debility. At this time even *republican* governors appear to have been ashamed of their brutal conduct towards such an extraordinary man; in consequence of which a decree was passed for restoring him to his chair in the university, together with its emoluments; but this fit of generosity was too long in seizing them. He departed this life on the 5th of November, 1798, in the 61st year of his age, amidst the tears of his friends, and the regret of the public, in whose death the learned world has been deprived of one of its brightest ornaments.

GALVANISM.

Experiment showing

If two pieces of metal, the one of zinc, and the other of silver, or the one of zinc and the other of copper, or, what answers the purpose equally well, a penny piece and a half crown piece, be so placed that the one shall touch the upper surface of the tongue, and the other shall touch its under surface, while the edges project over the point; as often as the edges of the metals in this situation are brought into contact, a peculiar sensation is produced in the tongue; there is something like a slight shock of electricity, and there is perceived at the same time an austere, astringent, or metallic taste.

If a bit of tin-foil be placed on one of the eyes, and a bit of copper held between the teeth or touching the tongue, and a communication be formed by means of a wire between the piece of metal on the eye and that on the tongue, a flash of light is seen, and this is produced as often as the communication is completed. But, in the above experiments, if metals of the same kind be employed, no perceptible effect whatever is produced.

If a pile composed of 50 or 60 pairs of plates of zinc and silver, or zinc and copper, be arranged in a regular series, with pieces of cloth moistened in a solution of common salt placed between each pair; and if one hand, previously moistened with water, touch the lower pair, and the other hand, also moistened, touch the upper pair of plates, the moment the communication between the bottom and top of the pile is completed, a smart shock is felt; and if 50 or 60 pairs of plates of copper and zinc be arranged in a trough as will be afterwards described, and the spaces between the pairs be filled with water, to which about $\frac{1}{10}$th of pretty strong nitric acid has been added, a similar shock is perceived, when the hands wetted with water touch the plates at the extremities of the trough. If a communication by means of wires and two pieces of well-prepared charcoal be made between the extremities of the trough, a very brilliant combustion is excited every time the two pieces of charcoal are brought into contact. By placing tin-foil, gold leaf, white or yellow Dutch metal or brass leaf, on a wire connected with one end of the trough, and touching the metallic leaves with a plate of copper or zinc connected with a wire from the other end of the trough, a rapid and brilliant deflagration is exhibited every time that the communication is effected.

2
What is understood by galvanism.

The phenomena which are thus produced have received the name of *Galvanism*, from the name of Galvani, who first observed and published an account of some of them, and the power by which these effects are produced has been denominated the *galvanic power* or *fluid*. From its effects on animals being similar to those of the electrical fluid, it was at first called *animal electricity*; but then the knowledge of galvanism was limited to its effects on animals, and it was supposed to depend on something peculiar to animal life.

In the following treatise we propose to give a view of the progress and present state of galvanism; and for this purpose we shall arrange the whole under two great divisions. Under the first, we shall consider the phenomena of galvanism, or detail the facts which have been ascertained with regard to this power. The second part will be occupied in the history, progress, and theories, which have been held with regard to the nature of galvanism.

PART I. OF THE PHENOMENA OF GALVANISM.

Arrangement.

IN treating of the phenomena of galvanism, its progressive history suggests an arrangement sufficiently convenient for taking a view of the effects of the galvanic fluid. Those effects, which are to be regarded as strictly chemical, were altogether unknown, till after its application to animals, and a great mass of facts relative to its effects on animal life had been accumulated. We may therefore first consider the effects produced on animals by the operation of the galvanic fluid, and in the next place those effects which are strictly chemical. But before we proceed to this, it is necessary that the nature and construction of the apparatus, by which these effects were produced, should be understood. These topics, therefore, shall be the subjects of the three following chapters. In the first we shall treat of the construction of the apparatus by which the phenomena of galvanism are produced; the second will be employed in considering the effects of the galvanic fluid on animals; and the third will comprehend a view of its chemical effects.

Construction of Apparatus.

Chap. I. *Of the Construction of the Apparatus for exhibiting the Phenomena of Galvanism.*

4 Apparatus at first simple.

On the first discovery of galvanism, the apparatus for exhibiting its effects was extremely simple. It consisted merely of two pieces of different metals, such as has been described above, by which a peculiar sensation is produced on the tongue. This, it has been stated, is effected by means of a piece of zinc and a piece of copper, the one placed on the upper surface, and the other on the under surface of the tongue, while the projecting edges are brought into contact. In the same way, and with such an apparatus, a great variety of experiments, especially in cold-blooded animals, were exhibited, when the knowledge of this remarkable power was first announced and investigated.

Plate CCXXIX. fig. 1.

For the purpose of exhibiting some of the simpler effects of galvanism, we shall describe the following apparatus, which is of very easy construction. AB, fig. 1. is zinc wire, sharp at the point A, and fixed in the wooden stand C. If the frog prepared in the way which we shall immediately describe, be fixed on the point of the wire at A, and a gold or a silver wire (a silver tea spoon will answer the purpose) be brought into contact with the side of the wire as at the point D; and while in contact with the wire at D, it is brought into contact with the feet of the frog at E or F, the effect of the galvanic power will be immediately perceived. The limbs of the animal will be strongly convulsed, and will exhibit as much motion by the contraction of the muscles as if it were alive, and in full vigour. But if a zinc wire, similar to AB, were substituted for the gold or silver wire, no such effect would be produced.

5 Methods of preparing frogs for experiments.

Frogs, as they are most easily found, and as they are, perhaps, more convenient in other respects, have been oftener the subject of galvanic experiments than any other animal. To prepare them for these experiments, various methods have been followed. Some physiologists propose to remove only the integuments, and lay bare the muscles, while others open the cavities of the thorax and abdomen, remove the viscera which are contained in these cavities, and bring into view the nerves and muscles which are there distributed. Some again, after the above previous preparation, separate all the parts between the origin of the nerve and its insertion in the muscle, so that the latter may be attached by means of the nerves only, to the trunk of the body; while others, after a similar preparation, cut off the animal's head, that the effects produced by galvanism may not be confounded with the voluntary movements of the living animal. By another mode of preparation, each of the parts is separated from the body by dissection, after laying bare the muscles and nerves.

But in general a frog is understood to be prepared when it is divided with a pair of scissars into two portions, through the middle of the body and spine. The viscera are then removed, as well as the integuments of the inferior extremities. As the sciatic nerves of this animal rise very high upon the spine, they are distinctly seen after this treatment. When it is intended, as in some experiments, to arm the nerves, as it is called, a pair of sharp-pointed scissars is introduced beneath them, and the spine is cut through, but without dividing the nerves. A portion of the inferior part of the spine is afterwards to be separated, that room may be left for covering the nerves with a bit of tin-foil. This is what is usually understood by arming or coating the nerves. In some experiments it will be found more convenient to separate the lower extremities from the trunk, and to employ the crural nerve.

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Phenomena similar to the above may be produced by placing a frog A prepared in the way described above, on a plate of zinc B, fig. 2. and on a plate of silver or copper C. If the communication between the plates A and B be completed by means of the conductor D, the muscles of the frog are immediately thrown into strong convulsions, and these motions are renewed as often as the contact is made by the conducting wire and the two metals. Fig. 2.

6 Single galvanic combination.

The apparatus we have now described affords an example of the simplest galvanic combination, or what is usually denominated a single galvanic combination. Here it may be observed, that this combination must consist of three different conductors. The conductors of electricity have been arranged into two principal classes: to the first belong the metallic substances and charcoal, which have been otherwise called dry and perfect conductors; the second class consists of the imperfect conductors, which are water and other oxidating fluids, and the substances which contain these fluids. But although the conductors of electricity, for the sake of conveniency, are thus arranged, they differ from each other in their conducting power, and this difference is greatest among the substances comprehended under the second class. Now, if the three conductors of the galvanic fluid be all of the first class, or all of the second, the effect is scarcely perceptible. An active, simple galvanic combination, then, must consist of three different bodies, one conductor must belong to one class, and two different conductors must be taken from the other class. In fig. 3. and 4. are exhibited examples of active simple galvanic combinations. In fig. 3. the letters AB mark the bodies belonging to the first class or perfect conductors; and *a* marks the body belonging to the second class, or imperfect conductors; and in fig. 4. A marks one body belonging to the first class, and *a b* two bodies belonging to the second class, or the imperfect conductors. Of the three bodies forming a galvanic combination, if two of them belong to the first class, and one to the second, this combination is said to be of the first order; but if one of the three bodies only belong to the first class, and two to the second, the combination is said to be of the second order. Fig. 3. is a galvanic combination of the first order, and fig. 4. is one of the second. This may be further illustrated by examining fig. 5, 6, 7, which consist of two bodies only, and therefore are not active combinations; and also by examining fig. 8 and 9. which consist of three bodies, but two of them are of the same kind, and therefore act as a single body. In the last five figures, the capital letters denote the bodies belonging to the first class, and the small letters those belonging to the second. Fig. 3 and 4. Fig. 8, 9.

In the single active galvanic combination, or the simple galvanic circle, the two bodies of one class must be in contact with each other in one or more points, while, at the same time, they are connected together at other points

points with the body belonging to the other class. Thus, if a prepared frog is convulsed by the contact of the same piece of metal in two different places, the fluids of those parts, which must be somewhat different from each other, are the two conductors of the second class, and the metal constitutes the third body for the conductor of the first class. But if two metals be employed, the fluids of the prepared animal differing little from each other, are to be considered as one body of the second class.

Here it may be necessary to anticipate a little, by observing, that in a simple galvanic circle, the conductor or conductors of one class must have some chemical action upon the other conductor or conductors, otherwise no galvanic action would be produced, or at least a very feeble one, from the combination of three bodies. This galvanic action, too, seems to be in proportion to the degree of chemical action, from which some have supposed, that this chemical agency is the primary cause of the phenomena.

It is found that the most active galvanic combinations, or galvanic circles belonging to the first order, are those in which two solids possessing different degrees of oxidability, are combined with a fluid which is capable of oxidating at least one of the solids. Gold, silver, and water, do not form an active galvanic combination, because water is incapable of oxidating either of these metals; but if a small quantity of nitric acid, or any other fluid which may be decomposed by the silver, be mixed with water, an active galvanic circle may thus be formed.

If zinc, silver, and water, or zinc, copper, and water, be combined together, an active galvanic circle is formed, and the water will be found to oxidate the zinc, if it hold any portion of atmospherical air in solution, and still more so, if it contain oxygen. But the combination of the same substances forms a much more powerful galvanic circle, if a little nitric acid be added to the water, because then the fluid has a strong action on the zinc, and oxidates it.

Galvanic combinations belonging to the second order are found to be most powerful, when two conductors of the second class have different chemical actions on the conductors of the first class, while at the same time they have an action upon each other. As an example of this, copper, silver, or lead, combined with a solution of an alkaline sulphuret, and diluted nitric acid, constitute a very active galvanic circle.

The following is a list of galvanic circles of the first order, composed of two conductors of the first class, and one of the second.

Zinc with gold, or charcoal, or silver, or copper, or tin, or iron, or mercury; and water containing a small quantity of any of the mineral acids.

Iron, with gold, or charcoal, or silver, or copper, or tin, and a weak solution of any of the mineral acids, as above.

Tin, with gold, or silver, or charcoal, and a weak solution of any of the mineral acids, as above.

Lead, with gold, or silver, and a weak acid solution, as above.

Any of the above metallic combinations, and common water, viz. water containing atmospherical air, or especially water containing oxygen air.

Copper, with gold, or silver, and a solution of nitrate of silver and mercury; or the nitric acid; or the acetous acid.

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Silver, with gold, and the nitric acid.

9 Of the second order.

The following is a list of galvanic circles of the second order, consisting of one conductor of the first class, and two of the second.

Charcoal, or Copper, or Silver, or Lead, or Tin, or Iron, or Zinc,	with water, or with a solution of any hydrogenated alkaline sulphurets, capable of acting on the first three metals only;	and a solution of nitrous acid, or oxygenated muriatic acid, &c. capable of acting upon all the metals.

But the effects of the galvanic fluid are extremely feeble, when they are limited to the operation of even the most powerful simple combinations. In the progress of the knowledge of galvanism it was soon found, that these effects might be combined and increased to almost any degree. This is done by connecting together a number of active simple combinations, which, it is to be observed, must be so disposed that they may not counteract each other. A number of simple combinations thus connected together have received the name of *batteries;* and these batteries are said to belong to the first and second order, according as the simple combinations of which they are formed, are composed of substances of the first or second order of conducting powers. Thus, for example, if a plate of zinc be laid upon a plate of copper, and a piece of moistened card or leather be laid upon the zinc, and a similar arrangement of three other pieces be laid upon the first, and any number of combinations of the same kind be continued, taking care that they are always arranged in the same order, the whole will form a battery of the first order. But if a plate of copper be connected with a piece of cloth moistened with water, and the latter with another piece of cloth, moistened with a solution of sulphuret of potash, and this be connected with another piece of copper, repeating the same series to any convenient number, a battery of the second order will be formed of the whole.

10 Batteries.

Batteries of the second order have been arranged by Mr Davy into the three following classes. 1. The most feeble battery is composed, when single metallic plates are so arranged that two of their surfaces or opposite extremities are in contact with different fluids, the one of which is capable, and the other is incapable, of oxidating the metal, a regular series of such combinations are formed. 2. When single combinations or elements of the series are each composed of a single plate of a metallic substance, capable of acting upon sulphurated hydrogen, or upon sulphurets dissolved in water, accompanied with portions of a solution of sulphuret of potash on one side, and water on the other. 3. The third class is the most powerful, being formed when metallic substances oxidable in acids, and capable of acting on solutions of sulphurets, are connected as plates with oxidating fluids, and solutions of sulphuret of potash, and so arranged that the opposite sides of every plate may undergo different chemical changes, the mode of alteration being regular.

11 Couronne de tasses.

The first attempt to increase the effects of the galvanic fluid, by combining a series of simple circles, was made by Volta; to this he gave the name *couronne de tasses.*

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tasses. The following is the construction and mode of applying this apparatus.

Fig. 10.

Take any number of cups or glass tumblers A, B, C, D, E, fig. 10. Fill them about three-fourths full with any of the saline solutions, which will be afterwards described, as that of common salt or sal ammoniac in water. To one extremity of a bent brass wire solder a plate of zinc of about two inches in diameter, and to the other extremity of the same wire, solder in the same manner a plate of copper of the same diameter. These connecting wires are represented in the figure by the letters *a*, *a*, *a*, *a*; and the plates of the different metals are marked with the letters Z and C, viz. zinc and copper. In arranging the plates in the vessels, it ought to be observed, that a plate of zinc and a plate of copper belonging to different wires, must be in the same vessel, and never two plates of the same kind. Thus in the first vessel A, there is a plate of copper; in the second B, connected by the same wire, there is a plate of zinc; in the same vessel B, there is also a plate of copper, which is connected by means of another wire to a plate of zinc in the third vessel C. The same order and arrangement are to be observed to whatever number of plates and vessels the series may extend.

Suppose now that the apparatus has been arranged in the way described above, and the vessels have been filled with a solution of common salt in water; if the number of vessels be not less than ten or twelve, a slight shock will be felt by immersing one hand in the vessel, at one extremity of the series, and the other hand in the vessel at the other extremity; as for instance, by putting the fingers of one hand in the vessel A, fig. 10. and suddenly plunging the fingers of the other hand in the vessel E. The shock will perhaps be more sensibly felt by previously wetting the palms of both hands, and taking a silver or pewter spoon in each hand, immerse the handle of the one into the vessel A, and the handle of the other into the vessel E.

The strength of this apparatus depends on the number of series of plates and vessels employed. But it is obvious that this series, from the nature of the apparatus, could not be greatly extended, so as to afford any great increase of power. This occurred very early to the ingenious discoverer, as an insurmountable objection to the use of this apparatus. The views of this philosopher in investigating the nature of galvanism, seem at this time to have been chiefly directed to the discovery of instruments or apparatus, by means of which he might be enabled to augment its power. In the prosecution of his inquiries, therefore, he contrived another apparatus, which was afterwards known by the name of the galvanic pile, and sometimes, but more rarely, by that of the voltaic pile or pile of Volta, from the name of the discoverer. This apparatus is constructed in the following manner.

12
Pile of Volta.

A pile of moderate strength may be constructed of 60 pairs of plates of zinc and copper, each plate being about two inches diameter; it may be constructed also with similar plates of zinc and silver, or of almost any two other dissimilar metals. Such piles have been very conveniently constructed, with half crown pieces and plates of zinc of the same size, or more conveniently with penny pieces and plates of zinc of the same diameter. But of whatever different metals this kind of apparatus is to be constructed, the same order of arrangement is to be observed throughout the whole series.

Suppose the metals to be employed in the construction of the pile are zinc and copper, (and these from views of economy have been most frequently employed), an equal number of pieces of cloth, pasteboard, or leather, of the same diameter with the metallic plates, is to be prepared. The use of these pieces of cloth is to retain the moisture, by means of which the communication between the plates is formed, and the galvanic combinations are completed; and in proportion to the length of time during which the pieces of cloth or other substances retain the fluid which they have absorbed, the operation of the pile continues. The pile is formed by placing a pair of plates, one of zinc, and one of copper, upon a stand, the one immediately above the other. Upon this pair of plates is then placed a piece of cloth which has been soaked in some saline solution, as that of common salt, or sal ammoniac. Upon this piece of cloth is placed another pair of plates, arranged in the same order as the first pair. It makes no difference which of the metals is placed first in the series, only it is necessary to take care that the same order be observed throughout the whole pile. If the series, for instance, begins with copper, it runs in the following order: copper, zinc, cloth; copper, zinc, cloth, &c. to whatever number of pairs of plates and pieces of cloth the series may extend.

But if the number of series amount to 60 pairs, it will be necessary to have rods to confine the pairs of plates, and to retain them in a perpendicular column; for without this the weight at top would be so considerable that the least inclination to one side (and this could not well be avoided) would derange the whole apparatus. The rods which have been employed for this purpose have been sometimes made of glass, and sometimes of wood. When wood is used, it should be pretty dry, or baked, by which means its conducting power is either greatly diminished or entirely destroyed.

The pile being constructed in this manner, its effects may be observed, by applying the fingers of one hand moistened with water to the lowest pair of plates, and then touching with the fingers of the other hand, moistened in the same manner, the upper pair of plates, thus completing the communication between the extremities of the pile. Every time that this communication is made, a sensation is experienced, similar to a slight shock of electricity. The intensity of this shock is in proportion to the number of the pairs of plates, the nature of the fluid employed, and the care with which the pile has been erected, or the time that it has continued in action. With a pile of 60 pairs of plates, the shock will be perceptible through the fingers, or the whole of the hand, and in some persons, when it is in full activity, it will extend as high as the elbows.

In making experiments with this kind of apparatus, it will be found that 50 or 60 pairs of plates will be a sufficient number to be erected in one pile; but to increase the power of the galvanic fluid, a number of piles may be connected together. This may be done in two ways; either by combining the separate action of the different piles employed; as, for instance, if three piles are constructed, let the pairs of plates be arranged in

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in each exactly in the same way, and let the conducting substances, as wires, pass from the top and bottom of each to one common conductor. In this case we have the action of three different currents of the galvanic fluid; but whatever number of piles may be employed, their mutual action may be so combined, that the whole effect may be produced by one single current. Suppose the metallic plates of one pile are arranged in the following order; copper, zinc, cloth; copper, zinc, cloth, &c.: then the plates of the second must be arranged in a different order, namely, zinc, copper, cloth; zinc, copper, cloth, &c. and the plates of the third in the same way as the first, viz. copper, zinc, cloth; copper, zinc, cloth, &c. The three piles being thus arranged, let a metallic conductor, as a slip of copper or zinc, be placed between the tops of the first and second pile, and a similar conductor be placed between the bottom of the second and third piles; and when they are thus connected together, let the fingers of one hand, moistened, be placed at the lowest pair of plates of the first pile, and the fingers of the other hand, also moistened, be brought in contact with the upper pair of plates of the third, a violent shock will be felt. The shock will be the same as if the whole number of pairs of plates of which the three piles are composed were formed into a single pile; for the same order of arrangement being observed from the bottom of the first pile to the top, and from the top of the second pile to the bottom, and again from the bottom of the third pile to the top, the current passes uninterruptedly through the whole series, as if it were uniformly arranged in one pile.

The effects of this apparatus may be farther observed in its chemical action. If the circle is completed, or the communication between the extremities of the apparatus by means of charcoal be formed, a spark is produced. This is done by attaching a piece of well prepared charcoal to a wire which communicates with one extremity of the apparatus, and another similar piece of charcoal to another wire communicating with the other extremity; if the two pieces of charcoal be brought into contact, thus completing the circle, a spark will be observed, and this may be repeated as long as the activity of the pile continues. The chemical effects of such an apparatus are also exhibited in the decomposition of water. The apparatus for effecting this decomposition, and the method of using it, will be afterwards described.

But it was soon found that the effects of this pile, although when it is first erected it possesses considerable energy, in a very short time it becomes extremely feeble, and at last altogether imperceptible. This is owing to the pieces of cloth or other substance which is interposed between the pairs of plates being deprived of their moisture, either by evaporation, or by being squeezed out, from the weight of the plates. The latter effect, it is obvious, must be in proportion to the height, and consequently the incumbent pressure of the upper on the lower part of the pile; and besides this, the liquid as it oozes out, trickles down the sides of the pile, so that the different pairs of plates are less perfectly insulated than they otherwise ought to be, to produce the full effect.

Various contrivances were thought of to obviate these inconveniences, and the first which was proposed was announced by the ingenious inventor of the pile himself. Volta inclosed his piles, after they were erected, with wax or pitch. By this contrivance which he put in practice on two columns or piles, each consisting of 20 plates, he succeeded so far in preventing the inconveniences alluded to above, that their effects continued nearly undiminished for several weeks. By other contrivances the plates and pieces of cloth or pasteboard were arranged horizontally, by which means some of the inconveniences of the upright column were avoided; among these the unequal pressure was removed, but still it was found that the evaporation continued, so that it was not long before its operation began to diminish, and at last to be entirely interrupted.

As it was found that the chemical effects of the pile were greatly increased by employing plates of a larger surface, even when the number was greatly diminished, piles were erected both on the continent and in Britain, with plates from 10 to 14 inches square. Twelve or fourteen pairs of plates of the above size, arranged in the same way as those which have been already described, produced very considerable chemical effects, such as burning phosphorus, setting fire to gunpowder, and deflagrating gold and silver leaf. The pieces of thick cloth or pasteboard moistened with water, to which a certain proportion of nitric acid was added, were usually employed in the construction of this pile; but it is unnecessary to mention that it was attended with similar inconveniences to those which accompanied the smaller pile. These inconveniences probably led to another and more effectual contrivance for exhibiting the effects of galvanism. But before we give an account of these, we shall farther illustrate the nature and construction of the pile with an explanation of fig. 11. and 12.

Fig. 11.

Fig. 11. is a representation of a pile composed of copper, zinc, and pieces of pasteboard, soaked in some saline solution. The pile is erected on the stand A, and the different parts of which it is composed are retained in their perpendicular position by means of the three rods made of glass or baked wood, *b*, *b*, *b*. The pieces of metal are marked *c*, *z*, and the pasteboard *p*, in the order in which they are placed. The pile being erected from bottom to top in the same order, let a piece of wire *e* be inserted under the lower pair of plates, and let another wire *f*, be kept in contact with the upper surface of the upper pair of plates; the different parts being thus disposed, if the fingers of one hand moistened be brought in contact with the wire *e*, and the fingers of the other hand, also moistened, be brought in contact with the wire *f*, a shock will be felt, and thus it will be found that the energy of the pile will continue till the moisture of the pieces of pasteboard has evaporated, or the peculiar change which takes place on one of the metals during its action, and which will be taken notice of afterwards, has been effected.

Fig. 12.

Fig. 12. exhibits a view of a combination of three piles, A, B, C. In the column A the arrangement is copper, zinc, pasteboard; copper, zinc, pasteboard, &c.: in the column A, this arrangement is reversed, from the bottom of the column, which is zinc, copper, pasteboard; zinc, copper, pasteboard, &c.; because it must be the same as if the column B were placed upon the top of the column A, the points A and B being brought into

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into contact, only having a piece of pasteboard interposed. The third column C is arranged in the same manner as the column A, viz. copper, zinc, pasteboard; copper, zinc, pasteboard, &c. Thus, then, the three columns are so arranged, that the different series succeed each other from the bottom of column A to the top, from the top of column B to the bottom, and from the bottom of column C to the top, as if the whole had been disposed in one column A. A communication is then formed between the top of the column A and the top of column B, by a metallic conductor D, and between the bottom of column B, and the bottom of column C, by means of the metallic conductor E. If then the fingers of one hand moistened are brought into contact with the wire F, which communicates with the bottom of column A, and the fingers of the other hand also moistened are brought into contact with the wire G, a smart shock will be felt, from the combined action of the three columns or piles.

The inconveniences of the pile, as we have already hinted, were soon felt by those who were eager in the investigation of galvanism, and who wished their experiments to continue with undiminished energy, that they might be enabled to ascertain with precision the new and curious facts which presented themselves. These inconveniences, it is very probable, suggested the improvements in galvanic apparatus which we are now to describe.

13 Galvanic trough.

By the invention of the trough, for which we are indebted to the ingenuity of Mr Cruikshank of Woolwich, the progress of galvanism became rapid and brilliant; for by this means philosophers were enabled not only to give a longer duration to their experiments, but to command a degree of energy in the galvanic fluid, which, before the discovery of this apparatus, was not even suspected. This apparatus, we believe, is now almost universally employed for galvanic experiments. We shall therefore give a more detailed account of the method of constructing and using it.

Troughs with plates of various sizes have been constructed, from 2 to 6, 8, and even 14 inches square; but, as an example, we shall suppose the following trough to be constructed with plates of about four inches square. A wooden trough AB, fig. 13. is to be made of baked mahogany; the length may be about 30 inches, and, as we shall suppose the number of pairs of plates to be 50, an equal number of grooves is to be cut on the sides and bottom of the inside of the trough. These grooves are to be cut at equal distances from each other, and the width of each groove is to be such, as to correspond nearly to the thickness of each pair of plates, so that the latter may slip easily into the grooves.

Fig. 13.

14 Casting of the zinc plates.

The plates are like those which have been already described in the construction of the pile made of zinc and copper. No difficulty has ever occurred in procuring plates of copper for this purpose; because all that is necessary is to cut them out of sheets of copper of the requisite thickness to any size that is wanted. But the case has been very different with regard to plates of zinc, especially where large plates were required. Attempts have been made to cast them in moulds of sand, such as are used for casting different utensils of other metals; but these attempts, it would appear, have been generally unsuccessful. The method which it is said has succeeded best in forming plates of any considerable size is the following. The zinc of which the plates are to be composed is to be melted in a narrow-mouthed vessel, so that a small surface of fused metal may be exposed. The reason of this is, that the metal when it reaches a certain temperature is very rapidly oxidated in consequence of the strong affinity between this metal and oxygen. The metal in this state is converted into a fine flocculent substance, known by the name of flowers of zinc. This change, therefore, as it is attended with a loss of the metal, is to be as much as possible avoided. A mould of stone of the dimensions of the proposed plates (in this case four inches), and about one-eighth of an inch in thickness, is to be prepared; but one formed of brass is found to answer the purpose still better. When the metal is in perfect fusion, the plates should be cast as quickly as possible, because, as the metal cools rapidly, cavities and imperfections would appear on the surface from its flowing unequally.

The plates of zinc being prepared, plates of copper which need not exceed one-tenth of the thickness of the zinc plates are to be cut out of a sheet of copper to the requisite dimensions, viz. corresponding to the size of the zinc plates. The copper plates must be reduced by hammering to a smooth and plane surface that they may apply exactly to the surface of the zinc plates, and be in contact in as many points as possible.

Soldering the plates.

The plates being thus prepared are to be soldered together; but it must be observed that it is not to be through the whole extent of the plate. It is found quite sufficient to solder them about one-fourth of an inch from the edges. The solder employed for this purpose is soft solder; and great precaution must be observed that the union at the edges be so close as to prevent any of the liquid with which the cells in the trough are to be filled from entering between the plates; for otherwise the power of its action would be greatly interrupted or perhaps entirely destroyed.

The operation of soldering was performed with considerable difficulty by many workmen; at least, it was found that in many cases the plates were either not in contact when the dimensions were large, or the joints were not perfectly secure. We are not certain in what way this operation is generally performed, but we know that this difficulty has been obviated by the following contrivance. The inside angles on the edges of the plates, that is, on the sides of the plates which are to be united together, are filed away, so that, when the plates are brought into close contact, a triangular groove all round the edge of the pair of plates remains. This groove is filled with solder, and the operation is conducted in the usual way. Plates soldered according to this contrivance have been found to answer the purpose extremely well. But this inconvenience is now rendered less embarrassing since the discovery of rendering zinc malleable and flexible was made, for plates of zinc of this description are of a much more equal thickness, are thinner and smoother, so that the copper can be brought into a closer contact. The plates which have been prepared of malleable zinc have the copper folded over the edge of the zinc plates, and in this way they are secured without difficulty, by soldering.

In whatever way the pairs of plates are to be secured, so that they may remain in close contact, they are afterwards

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wards to be fixed in the grooves of the box prepared for their reception; and here it is to be observed that each individual pair of plates is to be completely insulated. This is done by means of a particular kind of cement, the use of which is not only to retain the pairs of plates in their places, and to render their insulation complete, but also to defend the wood of the box against the action of the fluid which is employed to fill the cells of the trough.

16 Cement for securing the plates.

The cement which is employed for this purpose is composed of rosin, bees-wax, and fine brick dust, or powdered red ochre. Different proportions of these substances, it would appear, have been recommended in the construction of galvanic troughs. According to some, five parts of rosin, four of bees-wax, and two of powdered red ochre, are found to answer this purpose extremely well. The rosin and bees-wax are melted together, that they may be completely incorporated, and the red ochre is afterwards added. According to others, four ounces of bees-wax, eight ounces of rosin, and about an ounce of fine brick dust, melted together in the same way, are also found to answer the same purpose equally well. With this cement, the pairs of plates are secured in the grooves, and the intervening spaces on the inside of the bottom and sides of the trough are also covered with it, to defend the wood from the action of the fluid. It is scarcely necessary to observe, that the plates are to be arranged in the same way throughout the trough as the first pair; that is, if the copper side of the first pair of plates be towards the end of the trough at B, all the other pairs are to be so arranged as to have their copper sides towards the same point B, and the zinc sides towards the other end of the trough A. The plates being arranged in this way, the end of the trough B is called the copper end of the trough or battery, and the end A is called the zinc end.

Superior advantages are derived from arranging the plates in this way, to that of constructing them in the method described for the pile; for in this way the fluid can be applied more equally and with greater facility; the apparatus is more convenient for performing experiments; its action continues for a considerably longer time, and there is little or no trouble in cleaning the plates after the operation. It is otherwise with the pile, for, after it has been once used, the surface of the zinc plates is so much oxydated, that before they can be employed again, they must be scoured or filed, which, it is obvious, must be a troublesome and tedious process; but in the trough the oxydated surface of the plates is cleaned in every successive operation, the fluid which is employed dissolving the oxide which has collected on the surface of the zinc plates.

Liquid to fill the trough.

In treating of the construction and action of the pile, we have already observed that different saline solutions were employed, to moisten the pieces of cloth or pasteboard interposed between the pairs of plates. These solutions were muriate of soda or common salt, muriate of ammonia or sal ammoniac, and sometimes sulphate of potash. Similar solutions will answer the purpose of filling the cells of the trough, but these are found to be weaker than solutions of the acids; and, besides, as they are apt to crystallize on the plates, it becomes extremely troublesome to clean the trough. Acid solutions, therefore, which are more powerful, have been properly preferred; and the acid which seems to answer best, on different accounts, is the nitric; the proportion to be employed, it is obvious, must vary according to the strength of the acid. Of the common acid of the shops, one part with 16 of water will form a pretty active mixture; but when the acid is stronger, it may be necessary to add 20 parts of water. But this mixture is attended with the inconvenience of the evolution of nitrous gas, which, it is well known, is extremely disagreeable, and is injurious to respiration; and, on account of the high price of nitric acid, when a large quantity of this mixture is required, it becomes very expensive. Sulphuric acid mixed with water has also been employed for the same purpose, and it is found to answer very well. The use of this acid, however, is liable to many serious objections. Its action is too rapid; and, by its operation on the zinc, hydrogen gas is disengaged in such quantity as to be inconvenient to the operator. So much heat is evolved during its action, that the cement which is used for securing the plates in the trough, is apt to be rendered soft and loosened. Muriatic acid also has been employed, and this is recommended by some as in different respects the most convenient. One part of muriatic acid and 16 of water form a mixture which answers the purpose extremely well. The action of this mixture is slow and uniform, and the quantity of hydrogen gas which is evolved is so small as to produce little inconvenience. The use of this acid is attended with another advantage, that the plates are kept uniformly clean.

Whatever mixture has been employed, unless the operation has been continued for a very long time, when it is emptied from the trough, it may be bottled up, and reserved for future use; and if the most powerful action of the trough is not required, the same mixture may be employed several times. Here it may be worth while to notice, that the precaution of emptying the trough should be invariably observed, as soon as the experiments for which it was filled and prepared are finished; by this management there will be a considerable saving, both of the fluid and of the surface of the plates, which undergo oxidation. In filling the trough with the fluid, it should be observed that it does not rise higher than about $\frac{1}{4}$ of an inch from the upper edge of the plates; and after the filling of the trough is completed, the upper edges of the plates, as well as the edges of the trough, should be carefully wiped dry, that there may be no communication between the fluid in the cells, but through the metallic substances.

A trough composed of 50 plates of three inches square will be found suitable for a great variety of useful and entertaining experiments; but when it is found necessary to produce a more powerful action of the galvanic fluid, a greater number of pairs of plates, or the same number with a larger surface, according to the nature of the action required, must be employed. We have already observed, that several columns or piles may be so constructed as to have the full effect of their combined action, in the same way as if they formed a single pile. By similar management, different troughs or batteries may be so arranged as to combine together the effects of each, as if they constituted a single trough or battery. And all that is necessary to observe is, that to whatever extent the series may be carried, the surface of each of the

Construction of Apparatus.

the plates must be opposed to the surface of a different plate; as, for instance, the zinc surface of one of the plates must be constantly opposite to the copper surface of the next plate in the series. The different troughs thus uniformly arranged, are to be connected together by means of metallic conductors. A slip of copper, for instance, about half the width of the trough, is inserted by its opposite extremities in the cells of the ends of two of the troughs.

When the plates are of a very large size, their weight, with that of the quantity of fluid required to fill the cells, renders the trough very unmanageable. It is then necessary to fix it in a frame of sufficient strength, to support its weight by means of axles of brass or iron, fixed to the outside of the box. By this contrivance the fluid can be easily poured out into a proper vessel placed under the trough.

We shall afterwards speak more particularly of the effects of plates of different extent of surface: here, however, it may be necessary to observe, that in combining together two or more troughs or batteries, to have the full effect of such a number of plates as may be employed, in proportion to the extent of their surfaces, the surface of the plates in each trough should be the same; otherwise, if troughs of different extent of surfaces be employed, the action of that trough which has the largest surface is diminished, and reduced to that of the action of the trough whose plates have the smallest extent of surface. This circumstance is necessary to be attended to, for, if it be overlooked in the construction or combination of different batteries, the effects will be so feeble as to produce disappointment without the cause being known.

In making experiments with the trough, the communication is to be formed between the two extremities, or the circle is to be completed in the same way as has been already directed in the management of the pile. For this purpose there is a projecting piece of wood fixed to the upper edge of each of the ends of the trough; this is perforated so as to admit a piece of wire which passes through to the fluid in the two last cells at the extremity of the trough. If then the wires are placed in this situation, and the moistened fingers of one hand touch the wire at one extremity, while the moistened fingers of the other hand are brought into contact with the wire at the other extremity of the trough, a shock will be felt; and in this way the circle is completed.

The other parts of the apparatus which are necessary to conduct experiments with a trough of this description, are so simple as scarcely to require any particular description. All that is wanted for deflagrating metals is to have a bent wire fixed at one extremity of the trough, and to have a polished plate of copper or zinc communicating with the other extremity of the trough by means of a flexible wire. The metal to be deflagrated is placed upon the bent wire, and the metallic plate is brought into contact with it.

18 Apparatus for decomposing water.

The apparatus for the decomposition of water is the following. A glass tube, G, H, fig. 11. about three inches long, and $\frac{1}{2}$ inch in diameter, is furnished with a tight cork at the upper end G, through which cork the wire *i* communicating with the upper part of the pile, passes. It may be also furnished with a cork at the other extremity H, but this must have grooves cut on its sides, to allow the water to escape from the tube. The wire K communicating with the bottom of the pile, passes through this cork; or without the cork at this extremity, if the tube is retained in its perpendicular position by any other contrivance, the wire K may be passed within the tube. When this operation is to commence, the tube is to be filled with water, the cork at the upper extremity G being made air-tight, and then it is to be inverted, and the extremity H to be placed in a small cup or bason of water; after which the wire K being introduced, the circle is completed between the wires through the medium of the water in the tube, the decomposition of which will go on as long as the communication and the action of the pile are continued. This process will be observed by bubbles of air escaping from one of the wires, and rising to the top of the tube; or if the wires are of gold or of platina, bubbles of air will be seen passing from the extremity of both wires, and this air collecting at the top of the tube, forces out a quantity of water equal to the space which it occupies. The same experiment may be made by means of a still simpler apparatus. If the wires communicating with the extremities of the pile are introduced into a small glass phial filled with water, and inverted in a bason of water, the same process of decomposition will go on.

But an apparatus which is rather more complicated, but at the same time sufficiently convenient, is usually employed for this purpose. A small brass cup, E, fig. 13. is supported by the wire F, which is fixed in the hole of the projecting piece of wood D, at one end of the trough; from the centre of the cup there arises a pair of brass pincers, which hold a piece of wire of gold or platina G. Over the pincers is placed a glass tube HI, which has at the upper extremity, I, a brass cap, to the inside of which is fixed another piece of wire of gold or platina. The two wires should be at a little distance from each other, as they appear in the figure. The tube is then filled with water, and is inverted over the pincers in the brass cup, which is also filled with water; and thus, by means of the water in the tube, a communication is formed between the two wires. A wire proceeding from the other extremity of the trough C, is connected with the top of the tube I, and, as soon as this comunication is formed, the process of the decomposition of the water in the tube commences; for the galvanic circle, or the communication between the extremities of the trough or battery is completed. The gases, as they are disengaged from the wires in the tube, rise to the top, and the water which occupied the space now filled with air, is forced out into the cup. This process goes on as long as the communication continues, or till the surface of the water is lower than the extremity of the upper wire, when the communication is interrupted, and then the operation ceases.

With these observations we conclude what was intended to be said concerning the construction of galvanic apparatus. We shall notice what may be farther necessary to be explained, in the course of the detail which is to be given of the experiments in galvanism, or of the influence of the galvanic fluid on animals, as well as its chemical effects. We, therefore, now proceed, in the following chapter, to the consideration of some of these phenomena.

Chap.

Effects of Galvanism on Animals.

CHAP. II. *Of the Effects of the Galvanic Fluid on Animals.*

119 Animal electricity.

It has been already observed, that the first effects of galvanism were exhibited on animals; and indeed it was supposed that these effects could only be exhibited by means of animals; and hence, from the coincidence which was observed with the properties of electricity already known, it was denominated *animal electricity*.

The first experiments which were made in investigating the nature and properties of the galvanic fluid, were chiefly performed on cold-blooded animals. It was indeed from observing its effects on them, as we shall find afterwards in tracing its history, that the discovery was first made. This discovery was made on the frog, and since that time the frog has been oftener the subject of galvanic experiments than any other animal. From being found in great numbers, from being conveniently got, as well as from the irritability of the muscular fibre, as it is denominated by physiologists, continuing for a long time, it has perhaps become the devoted victim of those investigations.

We have already mentioned a simple experiment with a prepared frog, in which it forms the communication between two dissimilar metals. When the frog, as in fig. 1. is prepared, that is, skinned, and the lower extremities separated from the spine, and suspended on the zinc wire AB, if the extremities of the frog be touched with a different metallic substance, such as gold or silver, while this metallic substance is in contact with the zinc wire at the point D, the limbs of the frog are thrown into convulsions, and this takes place as often as the communication is formed.

Soon after the discovery of Galvani, and after the result of his experiments and opinions on the subject of this discovery was announced to the world, the attention of philosophers became much occupied in repeating and extending these experiments. Among others, Valli, an Italian physician, instituted a series of experiments, an account of which was communicated to the French philosophers, who soon after repeated them. As these experiments afford us not only a pretty full view of the effects of the galvanic fluid on animals, but also the state of galvanism at the time, we shall here detail them.

120 Experiments of Valli and the French philosophers.

Experiment 1.—When two metallic coatings or slips of metal, the one of lead, and the other of silver, were placed on a frog, fastened to a table, the coating of lead being placed on the belly of the animal, and that of silver on the pelvis, and a communication being formed by means of a slip or wire of copper, strong convulsive motions were produced in the animal.

Exper. 2.—The coating or slip of lead which was employed in the preceding experiment, was removed, and the abdomen was left bare. The copper wire was then applied to the abdomen the same way as before, while its other extremity was in contact with the coating of silver on the pelvis; convulsive motions were still produced, but they were less sensible than in the former experiment, and sometimes did not succeed at all.

Exper. 3.—When two coatings of the same metal were employed, as, for instance, silver or gold, the effects produced by means of copper forming the communication, were found to be much fuller; and when the coatings were of similar metals, such as copper, lead, or tin, and the metal forming the communication was the same, no effect whatever was produced.

Exper. 4.—By placing the coating on the abdomen in a horizontal direction, so that the points of contact became less numerous, the effects were found to be proportionally diminished; but when the coating was brought into full contact with the surface of the abdomen, it was observed that they became equally powerful as before.

Exper. 5.—A frog was skinned and cut transversely through the middle; the nerves of the thighs were laid bare, joined together, and placed on a slip of gold, while the thighs themselves were in contact with a piece of silver. When the metallic conductor of copper was applied, slight contractions were produced. It was found also that contractions took place when both the coatings were of silver; but when coatings of tin, copper, or lead, were substituted for the silver coating which surrounded the nerves, powerful contractions took place. The gradation observed in the action of the metals, is the following. Lead produced the strongest contractions, next the tin, and lastly the copper; but in proportion as the vitality of the animal diminished, the metals were found also to lose their power of producing motion. The metals which retained this property longest were lead, tin, and zinc.

Exper. 6.—When plumbers lead was employed on each side as a coating, and when the metal forming the communication was the same, no effect was produced; but when lead of different qualities, as, for instance, lead of the assayer and plumbers lead, was used, and the metal forming the communication being either the one or the other, very singular effects took place.

While it was found that these two kinds of lead, by changing the different metals, were no longer susceptible of producing any effect in one of the coatings, silver, gold, bismuth, antimony, or zinc, substituted for the lead, produced very powerful contractions; and, what seemed still more singular, when the pieces of lead in the first part of this experiment were re-applied, slight convulsions took place.

Exper. 7.—After a short interruption of the experiments on the same animal, it appeared that it became susceptible of pretty strong convulsive motions, when the same experiments were repeated.

Exper. 8.—When the galvanic power seemed to be nearly exhausted in the frog, it was found that the different metals, when they produced, by their contact, new convulsions, did not, when this effect could be no longer produced, leave to the animal the power of exhibiting anew any contractions with coatings of the different kinds of lead, as in experiment 6.

Exper. 9.—The following is the gradation of the diminution of effect, till it entirely ceased, when the plumbers lead always formed one of the coatings. With the assayers lead forming the other coating, the action became feeble, and it at last ceased. The next in order was tin, the next antimony, and so on in the order in which they are named as follows: zinc, copper, gold, silver. Iron, it was observed, had lost its power of producing any effect before the antimony; but whether it was deprived of this property before lead and tin, was not ascertained.

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Exper. 10.—Zinc, on losing the property of exciting convulsions in a frog, on which experiments had been made for an hour, was not found susceptible of any farther action, when the communication was formed by means of lead; but it was observed as a very singular circumstance, that contractions were still produced by this metal the moment that the person engaged in the experiment removed the conductor, and interrupted the circle. This experiment was frequently repeated.

Exper. 11.—The upper part of a frog which was skinned, and divided transversely, had the crural nerves, as in the former experiments, armed with a piece of lead, and placed in a glass filled with water, while the lower part was placed in another glass, also filled with water. Strong contractions were produced when the communication was formed by means of different persons holding each other by the hand, while two of them touched the water in the glasses. One of them held in his hand a piece of metal, which was brought into contact with the coating of lead.

Exper. 12.—When any one individual of the persons who thus formed the chain of communication between the two glasses withdrew himself, so that the communication was interrupted, no effect was perceptible.

Exper. 13.—When the frog was arranged in the same way as in experiment 11. having its parts placed in two glasses, no motion was excited when a communication was established with two fingers; nor was any motion produced, when a person with one hand armed with a piece of metal, touched the body of the frog, while he brought a finger of the other hand in contact with the metallic coating of the crural nerves. But by placing one finger on the inferior part of the frog, he touched with a piece of metal the coatings of the nerves, powerful contractions were produced.

Exper. 14.—When the animal was touched with a metallic substance in an insulated state, no perceptible effect was observed; but when the metals ceased to be insulated, very considerable motions were invariably produced.

Exper. 15.—The fore leg of a rabbit was separated from the body; the brachial nerves were laid bare and armed with a bit of sheet lead. The communication between the lead on the nerve and one of the contiguous muscles was made with a piece of silver, and strong convulsive contractions took place in the limb; but when this experiment was varied, by substituting for the metallic conductors, plumbers and assayers lead, no farther motion was produced. When one of the coatings employed was lead, and the other iron, no perceptible motion was observed. But when lead as one of the coatings, was employed with silver, gold, copper, zinc, or antimony, as the other coating, the motions and contractions of the limb were renewed. The motions were very slight, which were produced by means of a coating of bismuth, along with a coating of lead.

Exper. 16.—This experiment was instituted to ascertain the state of the electricity in the animal which was the subject of it. With this view, the animal was placed in a vessel containing one or two of Coulomb's electrometers, and it was then successively electrified, both positively and negatively; and in both of these cases the balls of the electrometer were so much influenced by the animal, as to shew, not only that its electricity was in a state of perfect rest, both before and during the time of the experiment, but also to exhibit in the system of the body on which the experiment was made, in a very distinct and striking manner, phenomena quite analogous to those of the Leyden phial.

Exper. 17.—The left crural nerve of a living frog was tied with a ligature so strongly, that the animal was deprived of the power of motion in that part of the limb below the point where the ligature was fixed; but when the nerve was armed with a metallic coating, in the way described in the former experiments, and a communication was formed between the part of the nerve above the ligature and the muscle, the motion and contraction of the limb were excited.

Exper. 18.—The ligature was afterwards placed on the left crural nerve, and brought in contact with the muscle. It was also fixed in such a way on the right crural nerve, so that part of it projected: the left part of the animal was then quite paralytic, and without motion, and the convulsive contractions which were produced when the communication was formed, were entirely limited to the right side; but when the same left crural nerve was more completely laid bare, and separated from the muscular substance which surrounded it, its conducting power was restored, and the communication being established, the convulsive motions became pretty strong. When, however, the ligature was again brought into contact with the muscle, the limb was again deprived of its power of motion.

Exper. 19.—One of the crural nerves of a frog being laid bare, was armed with a piece of sheet lead; and a communication having been formed between this nerve and the other crural nerve, which was unarmed, very strong convulsive motions were produced.

Exper. 20.—When one of the crural nerves was armed with two pieces of lead at different places in its course, and a communication formed between the two parts by a metallic conductor, violent agitations followed. It was observed, too, that the same effects took place, when the whole of the nerve was laid bare, and completely separated from the surrounding muscle.

Exper. 21.—A similar experiment was made on a hot-blooded living animal. The animal selected for this purpose was a guinea pig; but when the communication was established in the usual way, no effect followed, from which any thing precise or satisfactory could be deduced.

Length of time that motion can be produced in frogs.

With a view to discover during what length of time frogs, which were made the subjects of these experiments, could resist their effects, and retain the power of having motion excited in them, Valli made a number of experiments. At 10 o'clock at night he prepared two frogs, which on the following morning at seven o'clock he found had become extremely feeble, but not entirely deprived of the power of motion. Slight convulsions were excited in both by means of the galvanic apparatus; but an hour having elapsed, they ceased to afford any farther symptoms of vitality. No effort that could be made succeeded in producing motion. In other cases he prepared frogs, which by the following morning were found to be quite dry, and then no symptoms of motion could be exhibited. He separated several of the muscles from the body of a frog, and after having torn them, he found it impossible to

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to excite the irritability by any mechanical stimulus whatever; but, after previous preparation, and by means of a metallic conductor, motion was produced.

22 [Effects of narcotics on animals subjected to galvanism.]

The same naturalist made a variety of experiments, to ascertain the effects of galvanism on animals which were destroyed with opium, and other narcotic substances; but the results of his experiments on animals to which opium had been exhibited internally, as well as applied externally, were found to be very different from each other. Four frogs were destroyed by means of powdered tobacco, were rendered completely insensible to any mechanical stimulus, and seemed to be in a state of total stupefaction; but by the application of the galvanic apparatus, symptoms of vitality appeared, and slight motions were produced. A number of lizards being poisoned with tobacco, exhibited, at the time of their death, convulsive motions; but they still continued to afford symptoms of vitality and motion on the application of galvanism.

23 [Of hydrogen gas, &c.]

Animals were destroyed in a variety of ways, with a view of ascertaining what were the effects of galvanism, after the principle of life seemed to be extinguished. A small bird, which was for some time immersed in hydrogen gas, or inflammable air, shewed no symptoms of vitality or motion; but, on the application of galvanism, convulsive contractions of its limbs were produced. Two kittens were killed in azotic gas, and the fore legs were separated and prepared in the usual way. The same effects were produced as in the experiment with the bird.

Some animals were destroyed with the extract of hemlock; but it did not appear that the effects on the application of the galvanic apparatus were at all diminished by means of this poison. In frogs which were exposed to the exhalation of corrupted animal matters, perceptible motions were observed by means of galvanism; but these were very feeble.

Moscati deprived several frogs of life, by placing them in the vacuum of an air pump; and when these were subjected to experiment with the galvanic apparatus, slight motions were produced; but it was observed that these, although they followed each other in rapid succession, were excited with some difficulty. Here it was found that the blood was extravasated in the cellular membrane of the muscles, by which the flesh was tinged with a deep red colour. To this circumstance was ascribed the feeble effects produced in the above experiment, as it was supposed that the blood carried off part of the galvanic fluid, and thus prevented its action on the muscular fibres, through the medium of the nerves. This opinion was supported by another experiment, which was made on prepared frogs, in which there was no extravasation of blood; and in this case the galvanic effects did not seem to be in any degree diminished.

Before proceeding farther with an account of the experiments of the particular effects of galvanism on animals, we shall here relate two of a more general nature, the one with regard to the effects produced by the peculiar application of the metallic conductor, and the other with respect to the velocity of the galvanic fluid being increased, without increasing its intensity.

[Difference in effects of applying the conductor.]

A difference, which appeared to be a very singular fact, was observed in the mode of applying the metallic conductor, to excite motion in animals by means of galvanism. It was found, that the motions produced in the animal by this means were generally more powerful, when the conductor was applied, first to the muscles, and then to the coating, than if the reverse had taken place; that is, by applying first to the coating, and afterwards to the muscles; and indeed when the galvanic power began to be nearly exhausted, no motion whatever could be excited when the application was made, first to the coating and then to the muscles, while at the same time, by the contrary mode of application, motion could be easily produced.

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25 Velocity of the galvanic fluid increased without increase of intensity.

The other fact alluded to is, that the velocity of the galvanic fluid may be increased without increasing the degree of its intensity. This was proved by M. Valli in the following experiment. By means of a chain, which was in contact with the nerves of a prepared frog, he completed the galvanic circle. The animal at first exhibited convulsive contractions, but afterwards remained for some time without motion. When the conductor was removed to a very small distance, motion was again excited in the animal; soon after, however, this ceased. But when an insulated conductor was brought to the muscles of the frog, the motions were immediately renewed; and when they again ceased, a communication being formed between the operator himself and the conductor, the contractions were again excited. The conclusion which he deduced from the above experiment was, that the galvanic influence is constantly the same, however various the modes of its application. The same result, however, he observes, would not be obtained, if the experiment were made on an animal in which the principle of life was in full vigour.

From a number of experiments which were made by the same physiologist, it appeared that certain intervals were necessary, in order to obtain the same intensity of action in animals subjected to the influence of the galvanic fluid. Frogs, mice, rats, and tortoises, were the subjects of these experiments; they were destroyed by means of different poisons, or by respiring some of the noxious gases. In applying the galvanic apparatus to these animals, an interval of several minutes was required, when the motions excited became feeble, or had nearly ceased; and then, after this interval had elapsed, the same effects, and almost equally powerful as before, were produced.

26 Conducting power of blood vessels investigated.

With regard to the conducting power of the blood-vessels, two questions were proposed to Valli, by Vicq D'Azyr. 1. Whether the blood-vessels are to be considered as conductors of the galvanic fluid. And, 2. Whether, by coating the blood-vessels instead of the nerves, any motion through their medium could be excited? In the solution of these questions Valli observed, that the blood-vessels are undoubtedly to be considered as conductors of the galvanic fluid; but in whatever way this is effected, it seems to be through the nerves alone, in consequence of the way in which they are disposed, that muscular motion can be excited. The arteries and veins, he farther observes, are to be considered as less powerful conductors than the nerves; for no motion is obtained, if the vessels, without having any communication with the nerves, be distributed directly to the muscles. The tendons also, when the same communication is established, are also conductors as well as the bones, if they have not been deprived of the

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the periosteum. The membranes also possess this conducting power; but exhibit no motions when the communication with the nerves is interrupted.

It had been observed, that the nerves, when dry, exhibited, by means of friction, some symptoms of electricity. With a view to ascertain whether, in this dry state, the nerves were conductors of the galvanic fluid, and whether motions could be excited through this medium, Valli made several experiments; but in all these he was unsuccessful, for no motion was produced. In a series of experiments which were made on fowls, he found that ligatures applied to the nerves, did not prevent the contractions of the muscles, provided these ligatures were not applied to the nerves in immediate contact with the muscles.

27 Effects on drowned animals, &c.

In order to ascertain what would be the effects of the galvanic fluid on animals which were drowned or suffocated, Valli made a number of experiments. Several pullets were drowned, and kept so long under water, that no symptoms of life appeared. By the application of the galvanic apparatus, muscular contractions were produced in some, while others, by the same application, exhibited no motion whatever. The same experiment was repeated on six pullets, which were also drowned; and on the application of the apparatus, strong convulsive motions were produced. These continued for nearly the space of an hour. In others which were also drowned, the brain and wings were laid bare; and after this previous preparation, when the galvanic apparatus was applied, strong muscular contractions were excited: none of the animals, however, as was expected, were restored to life. Similar experiments, followed by the same result, were made on rabbits.

Several pullets were exposed to the action of different gases, as hydrogen, nitrous, and azotic gases, and did not afterwards, by any mechanical stimulus whatever that could be applied, exhibit symptoms of life. The galvanic apparatus being applied, very feeble contractions were produced; and these succeeded each other after long intervals. Similar experiments were made with the same view, on frogs, and it appeared that these animals could resist the effects of those gases better than the others. Nitrous gas, he found, was more injurious than hydrogen gas. In some of the frogs on which the experiments were made, the application of the galvanic apparatus produced violent agitations; but having repeated three or four shocks, no farther motion could be excited, not even after some interval had elapsed.

To ascertain what were the effects of different kinds of air on animals subjected to the galvanic apparatus, he separated the hinder extremities of a frog, exposed the one to the action of nitrous gas, and the other to that of atmospherical air. After being subjected for a short time to the action of these airs, the galvanic apparatus was applied. Contractions were produced in both; but those which were induced in the limb exposed to the nitrous air, were feebler than the other; and when the action of the nitrous air was continued beyond a very limited time, no motion whatever could be excited. The same experiment was made on limbs exposed to the action of hydrogen gas; and it appeared that its effects in destroying the irritability of the muscular fibre, or in diminishing its susceptibility of being acted upon by galvanism, were less powerful than the nitrous gas. Azotic gas was also found to produce effects on frogs somewhat similar. The heart was indeed observed to palpitate after the death of the animal; but, in general, the contractions which were induced by galvanism were extremely feeble.

It would lead us too much into detail to mention all the experiments which were made by this naturalist. We shall therefore only add a short account of the general results.

28 Results of Valli's experiments.

1. In frogs newly killed, he found, that a single metallic conductor was sufficient to excite convulsive contractions; and that in producing these motions, it was not found essentially necessary to apply a coating either to the muscle or nerve. Scissars, in which the steel appeared to be of a bad quality, might be successfully employed as a conductor; but gold, silver, copper, lead, and tin, in general, produced no effect.

2. The galvanic fluid was found to pass through glass and sealing wax; but it was necessary that these substances should have their temperature considerably increased.

3. Water in which the temperature was pretty high, or when raised to the boiling point, seemed to prevent the effects of galvanism from taking place, or at least diminish them greatly.

4. Water, the temperature of which was very much reduced, seemed also to be deprived of the property of conducting the galvanic fluid.

5. It was found, that when an individual formed part of the chain, in cases where the galvanic apparatus was applied to the prepared feet of rabbits, cats, and dogs, the latter were unsusceptible of motion.

6. The diaphragm of a dog was immersed in a vessel of water, and so placed in the vessel, that the phrenic nerve, previously armed, projected from it; and on touching the coating with a piece of gold or silver coin, while one of the fingers of the other hand was put into the water, feeble contractions were excited in the muscle. In some other experiments on the same muscle of horses, it was found that no motion could be induced by means of galvanism, while the same power, with the same intensity, constantly excited contractions in that of dogs.

7. A metallic wire, which was entirely covered with sealing wax, produced no motion in frogs, which began to be exhausted when it was employed as a conductor. This was stated by Valli, as a proof that the galvanic fluid passes along the surface of conductors.

8. A ligature on the nerve, when placed near to the muscle, or in contact with it, interrupted or diminished the effects of galvanism: it was found also, that a ligature, applied in the same way, prevented the effects of artificial electricity.

9. A ligature was applied, at a small distance from the muscle, to the crural nerve of a frog, and another was prepared in the same way, but without any ligature; these being subjected to experiment, it appeared that galvanism produced a more perceptible action in the latter than in the former.

10. Weak shocks of artificial electricity produce motion in the muscles of that leg only where no ligature has been applied to the nerve; but in the other, muscular contractions can be excited by means of the galvanic apparatus. From this experiment, it was attempted to deduce a method of subjecting the intensity of galvanism

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nism to calculation. If, for example, it is found that the effects of artificial electricity are considered as amounting to five, six, or seven degrees, and this power is insufficient to excite contractions, while they are produced by means of galvanism, it may be said that the latter is five, six, or seven degrees stronger than the former.

11. Valli did not succeed in effecting the muscular contraction of the heart by means of galvanism; nor did he succeed in similar experiments made on the stomach, intestines, or bladder, although he armed or applied metallic coatings to the nerves of all these organs.

12. To produce contractions in the wing of a fowl, the nerves of which were coated and previously steeped in oil, very powerful shocks of artificial electricity were found requisite; but the effects of the galvanic fluid did not, by this process, seem to be at all diminished: it retained its whole energy.

Experiments by Fontana,

Fontana, in his experiments and investigations on this subject, found, that he could accelerate the motions of the heart, when these motions were going on; and when the motions had ceased, could bring it to produce contractions. By placing the heart between two pieces of metal, zinc and antimony, so that it shall be in contact with both, and then forming a communication by means of a metallic conductor between the two metals, its motions are excited, even after it is separated from the body and cut in pieces. According to the experiments of Marsigli, part of the heart of a fowl, placed on a piece of charcoal, and another portion put on a piece of pasteboard, covered with tinfoil, gave repeated contractions, and was strongly convulsed.

by Delametherie

M. Delametherie made a variety of experiments, at a very early period, on this subject. The following are some of the general results of these experiments.

1. He found that the effects of galvanism in a prepared frog were feeble.

2. That it possesses the greatest intensity at the time when the animal has been just deprived of life; from this he infers, that the intensity of the effect must be greater in the living animal; from which he thinks it follows, that it is only by means of good conductors that the galvanic fluid can be conveyed from the nerves to the muscles of a frog; and it is by means of the metals, which may vary in the degree of their conducting power, that this communication is established.

3. Plumbago and charcoal were found to be inferior in their conducting power to metallic substances; but by their means the galvanic fluid could be conveyed from the nerves to the muscles of a frog.

4. He did not find from his experiments that this effect could be produced by forming the communications by means of animal substances; for when a person touched at the same time the nerves and muscles of a frog which had been laid bare, the same effect did not follow.

by Volta.

Volta, whose name has been already mentioned as the inventor and improver of the apparatus by means of which the galvanic power could be greatly increased, was, at the same time, one of the most zealous and the most indefatigable inquirers into its nature and properties. The views which this philosopher entertained with regard to the nature of this fluid, were different from those of Galvani. They are distinguished for their originality, exhibit a train of careful investigation, and have served as an excellent foundation on which the superstructure of galvanism was quickly raised. We shall therefore give a pretty full detail of the experiments and reasonings of this philosopher; and from the importance of his views, which we have stated above, it will not be less acceptable to the reader, if this detail be given, as we propose to do, in his own words. In this, indeed, something of what belongs to the second part of this treatise, will be unavoidably anticipated; but the sacrifice of strict method to perspicuity, will, we are persuaded, be readily admitted as a sufficient apology for this deviation.

To understand clearly the peculiar views which Volta has embraced in the observations which we have now referred to, it will be necessary to anticipate a little farther, by stating, that, according to Galvani, the fluid which bears his name is a peculiar kind of electricity, which resides in the organs of the animal, and is essentially and inseparably connected with them. But, according to the theory of Volta, the whole phenomena of the galvanic fluid depend entirely on artificial electricity, which is excited into action, or put in motion, when conductors of a different nature are brought into contact; and these, he thinks, are to be considered as the primary exciters. The motion of this fluid is induced in three different ways, that is, by means of three conductors at least, which are of a different nature, being so arranged as to form the communication or circle. In the first way, two metals or conductors of the first class, of a dissimilar nature, are employed. These are brought directly into contact by one of their extremities; but the communication between the other extremities is established by means of moist conductors, or conductors belonging to the second class. This fluid is put in motion another way, by a single metallic conductor of the first class, placed between two moist conductors of a dissimilar nature, between the latter of which a communication is established. In the third way of exciting the action of this fluid, or putting it in motion, a communication is formed among three conductors, each of which is of a different nature. To illustrate the variety of action observed in these conducting substances, the following account of the experiments of this naturalist, with his views and reasonings, was communicated by him in letters to Gren.

"If a tin bason, says he, be filled with soap-suds, lime-water, or a strong ley, which is still better, and if you then lay hold of the bason with both your hands, having first moistened them with pure water, and apply the tip of your tongue to the fluid in the bason, you will immediately be sensible of an acid taste upon your tongue, which is in contact with the alkaline liquor. This taste is very perceptible, and, for the moment, pretty strong; but it is changed afterwards into a different one, less acid, but more saline and pungent, until it at last becomes alkaline and sharp in proportion as the fluid acts more upon the tongue, and as the activity of its peculiar taste and its chemical power, more called forth, produce a greater effect in regard to the sensation of acidity occasioned by the stream of the electric fluid, which, by a continued circulation, passes from the tin to the alkaline liquor, thence to the tongue, then through the person to the water, and thence to the tin.

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tin again. I explain the phenomenon in this manner according to my principles; and indeed it cannot be explained in any other, as every thing tends to confirm my assertion, and to prove it in various ways. The contact of different conductors, particularly the metallic, including pyrites and other minerals as well as charcoal, which I call *dry conductors*, or of the first class, with moist conductors, or conductors of the second class, agitates or disturbs the electric fluid, or gives it a certain impulse. Do not ask in what manner; it is enough that it is a principle, and a general principle. This impulse, whether produced by attraction or any other force, is different or unlike, both in regard to the different metals and to the different moist conductors, so that the direction, or at least the power with which the electric fluid is impelled or excited, is different when the conductor A is applied to the conductor B, and to another, C. In a perfect circle of conductors, where either one of the second class is placed between two different from each other of the first class, or, contrariwise, one of the first class is placed between two of the second class different from each other, an electric stream is occasioned by the predominating force either to the right or to the left; a circulation of this fluid, which ceases only when the circle is broken, and which is renewed when the circle is again rendered complete. This method of connecting the different conductors will be more readily comprehended by turning to the figures, where the capital letters denote the different conductors or exciters (*moteurs*) of the first class, and the small letters those of the second class. Fig. 3. and 4. express the two cases above mentioned.

"I consider it as almost superfluous to observe, that when the circle consists merely of two kinds of conductors, however different or however numerous the pieces may be of which each consists, two equal powers are opposed to each other; that is, the electric fluid is impelled with equal force in two different directions, and consequently no stream can be formed from right to left, or, contrariwise, capable of exciting convulsive movements.

"There are other cases, however, and other modes of combination, where the powers are equally in equilibrium, and where no current of the electric fluid can take place; or, at least, none of such a force as to make an impression on the tenderest nerves, or to excite any convulsive movement in the best prepared frog that may be placed in the circle, notwithstanding the intervention of two or more different kinds of metals. This is the case when each of these metals is placed between two moist conductors, or of the second class, and which are very nearly of the same kind; or when, in a circle of three pieces, two of them of the same metal, and one of a different metal, are so connected, that the latter is immediately between the other two.

"When one of the ends of a piece of metal, which is a conductor of the first class, is immediately applied to another of the same class, but, instead of immediately touching with the other end, the other piece touches an intermediate conductor of the second class, either great or small, either a drop of water, a piece of raw or boiled flesh, or of sponge not moist, paste of meal, jelly, soap, cheese, or the white of an egg boiled to hardness; in this new combination, where a conductor of the second class is between two of the first class, the powers are no longer opposed to each other; and this is sufficient to determine an electric stream. When, therefore, a prepared frog is placed as the conductor of the second class, it will always be violently agitated as often as this circle is made complete.

"It may be readily perceived that the two last experiments coincide with those announced by M. Humboldt, where a drop of water, a small bit of fresh meat, or a very thin stratum of any fluid, performs the whole wonder. When another drop of water, or any other aqueous conductor, is applied between the other end of the first conductor and the other corresponding piece, each piece of metal is insulated, as I shall express it, between two aqueous conductors; but then the powers from right to left, and from left to right, are again completely opposed to each other; consequently the electric stream is impeded, and the frog remains without any movement. It is, therefore, absolutely necessary that two different metals or conductors of the first class, should be in immediate contact with each other, on the one side, while with their opposite ends they touch conductors of the second class.

"We might consider this mutual contact of two different metals as the immediate cause which puts the electric fluid in motion, instead of ascribing that power to the contact of the two metals with the moist conductors. Thus, for example, in fig. 3. instead of admitting two different actions, at least, in regard to the magnitude of the power, one where B comes in contact with a, and another where A comes in contact with a also, by which an electric current arises in the direction from A to B, we might suppose only one action at the point where B comes in contact with A, which impels the fluid in that direction. In both suppositions the result, as may easily be seen, is the same. But though I have reasons for adopting the first as true rather than the second, yet the latter represents the proposition with more simplicity, and it may be convenient to adhere to it in the explanation, as it affords a readier view of it. We may then say, that in the cases above stated, no effect will be produced, because here there is no mutual contact of different metals; the effect also will be null, when a conductor of the first class, on two opposite sides, is in contact with two others of the same class; for the actions therefore are in equilibrium; and, lastly, that an electric current will be occasioned by the action which arises from the contact of conductors of the first class, and which is counteracted by no other contact of the like kind.

"Having seen the result of employing three pieces of metal, or conductors of the first class, viz. two of one kind and one of a different, when combined sometimes in one way and sometimes in another, with conductors of the second class, we shall now try what will be the result, according to my principles, with four pieces of metal, two of which are of one kind, for example, zinc, when connected with moist conductors of different kinds.

"I shall first observe, that when they are connected in a circle, the powers which endeavour to put the electric fluid in a streaming movement, will be opposed to each other, and in perfect equilibrium, and that consequently no movement can take place in the frog, here supposed to be the moist conductor a, or a part of it, however irritable and well prepared it may be;

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be; and if the experiment be made with accuracy and the necessary precaution, so that the metals, in particular, be very clean and dry at the points of contact, it will perfectly confirm what I have above said; the frog will experience no agitation, no convulsive moment.

"These movements, on the other hand, took place, as might be foreseen from my principles, as often as I omitted one of the middle pieces, or changed the order.

"The conductors of the second class, which, in all the figures, are denoted by small letters, may be cups with water, in which the ends of the pieces of metal denoted by the large letters are immersed; or sponges or other bodies which have imbibed aqueous moisture. They may be either large or small, and may consist of one or more pieces, provided they be in proper contact; they may also be persons, if their skin be moistened at the places of contact, &c. By the last method the experiments will be very beautiful and incessant, when the circle consists of three or more persons (I have formed it frequently of ten, and even more), of two or more frogs properly prepared, and of four pieces of metal, two of silver and two of iron, tin, and particularly zinc. The change of effect, when you change the connection, is striking.

Fig. 14.

"Let the position be as represented in fig. 14. where g is the prepared frog, which the two persons p, p, hold in their hands, one on the one side by the feet, and the other on the opposite by the rump. Z, Z, are two plates of zinc, which are held also by these persons, and A, A two pieces of silver, which are held by a third person, denoted also by p. It must not be forgotten that the hands should be very moist, as the dry skin is not a conductor sufficiently strong. As in this chain the actions of the electric exciters are opposed to each other, and in exact equilibrium, as may be readily perceived, no convulsion or agitation in the frog will take place.

"Now, let one of the metallic pieces A, Z, which stand between the two persons, p, p, or between any other moist conductors, be left in combination as it is; and let the position of the two other metallic pieces A, Z, be reversed, by converting fig. 14. into fig. 15. (so that the actions, instead of being contrary, will act together to impel the electric fluid to one side or to produce the same current); or introduce between A and Z another person, or any other conductor of the second class, so that the chain be formed as in fig. 16.; or take away one of the pieces A, Z, in fig. 14. and make the chain like those of fig. 17. and 19.; or, in the last place, remove the whole two pieces A, Z, either in the one or the other side, as represented fig. 19. (by which means it will correspond with fig. 17. as the whole chain p, g, p, p, may be considered as a single moist conductor of the second class). In all these combinations, which are represented by fig. 15. 16. 17. 18. and 19. the actions arising from the metallic contacts are no longer contrary to each other, or in equilibrium, as they were in fig. 14.; consequently an electric stream is produced, and the frog g, which I suppose to be properly prepared, and which forms a part of the chain, will be violently agitated as often as the circle, when broken at any one place, particularly between metal and metal, is again restored.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18. & 19.

"In regard to the experiment where a moist conductor, or one of the second class, is to be introduced between the two pieces A, Z (fig. 16.), that is, between two different metals, a drop of water, or a small bit of moistened sponge, or a thin stratum of any fluid, soap, or any other viscous matter, will be quite sufficient, as has been already observed. This surprising experiment I generally make in such a manner, that, instead of the piece of the metal, I employ a cup or spoon filled with water, and then cause the person who holds the perfectly dry and pure stick of tin, to touch with the stick sometimes the perfectly dry sides of the spoon or cup, and sometimes the water contained in them. It is wonderful to see, that, as by the latter method, the violent agitation of the frog never ceases, the first method, which corresponds with fig. 14. does not produce the least irritation; unless by accident there be a small drop of water, or a thin stratum of moisture, at the place of contact, by which the case represented fig. 16. would be restored. This may serve to shew with what care and attention the experiment must be made, in order to guard against error or deception, which might so easily arise; and every where exhibit anomalies.

"When I introduce water or any other moist body, great or small, not merely between one pair of metallic pieces, A, Z, as fig. 16. but between two pairs, as represented fig. 20. each piece of metal is between like moist conductors, and by these means all the actions are again rendered contrary, or brought into equilibrium; or, according to the other mode of viewing the matter, there is no longer any action, for want of the mutual contact of two different metals, which, as we have seen, is certainly necessary to excite an electric current: and it is always found that the frog experiences no agitation.

Fig. 20.

"I shall not enlarge farther on these combinations, which may be varied *ad infinitum* with a greater number of metallic pieces, and by which one may be enabled to foretel the phenomena which, according to my principles, will always be found to take place. It will be sufficient, for the present, to draw this conclusion, that in a circle consisting merely of two conductors, however different they may be, their mutual contact can produce no electric stream sufficient to excite sensibility, or muscular movement; and that, on the contrary, this effect infallibly follows as often as the chain is formed of three conductors, one of one class, and two different from each other of another class, which come into mutual contact with each other, and that this effect will be stronger, the greater the difference is between the latter; that in other cases, where there are more than three different conductors, the effect either is not produced, or will be produced in different degrees, according as the forces called forth by the different combinations, which will be expanded at each heterogeneous contact, and which are often in opposition, and endeavour to impel the electric fluid in opposite directions, are perfectly in equilibrium with each other (which must be a very rare case), or when the sum of those which exert themselves in one direction is more or less exceeded by the sum of those which act in another direction.

"I shall here, however, leave the two complex combinations, and return to the simple cases, those with three different conductors, represented by fig. 3. which are more demonstrative; or, in other words, those with two

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two different metals or conductors of the first class, which are in contact with each other, and are applied on the other side to moist conductors, or conductors of the second class. This method has been commonly employed since Galvani's discovery, and is in exact proportion with the diversity of metals, on which I consider the whole phenomena to depend.

"The other method of combination, which is expressed by fig. 4. or that of a metal placed between two different moist conductors, for example, between water on the one side, and an aqueous, saponaceous, or saline fluid on the other, I discovered in the autumn of 1794; and though since that period I have repeated the much varied experiments of different persons, both foreigners and others, among which was that of Humboldt, and though I wrote to several correspondents respecting it, that light has not yet been thrown on this new phenomenon which it seems to deserve.

"The singular circumstance before mentioned, in regard to the acid taste when the tongue is brought into contact with an alkaline liquid, belongs, as you may perceive, to this second method of exciting the electric fluid, and putting it in circulation (if the tin vessel be touched on the outside by the hand moistened with water, and on the inside by the alkaline liquor), and shews that this current is no less strong and active than that excited by the first method, viz. by employing two sufficiently well-chosen metals, such as lead and copper, iron and silver, zinc and tin. I must here observe, that though with tin alone, placed between water and an alkaline liquor, you obtain nearly the effect which is produced by two of the most different metals, as silver and zinc, combined with any conductor whatever of the second class; you can obtain the same, and even in a higher degree, with iron alone or silver alone, when the iron is introduced between water on the one side and nitrous acid on the other, or when the silver is applied between water and a solution of sulphur or pot-ash.

"If you take a frog, the head of which has been cut off, and which has been deprived of all life by thrusting a needle into the spinal marrow, and immerse it, without skinning it, taking out the bowels, or any other preparation, into two glasses of water, the rump into one, and the leg into the other as usual, it will be strongly agitated and violently convulsed when you connect the water in both glasses by a bow formed of two very different metals, such as silver and tin or lead, or, what is better, silver and zinc; but this will by no means be the case when the two metals are less different in regard to their powers, such as gold and silver, silver and copper, copper and iron, tin and lead. But what is more, the effect will be fully produced on this so little prepared frog, when you immerse in one of the two glasses the end of a bow merely of tin or zinc, and into the other glass the other end of this bow, which has been rubbed over with a little alkali. You may perform the experiment still better with an iron bow, one end of which has been covered with a drop or thin coating of nitrous acid; and beyond all expectation, when you take a silver bow having a little sulphur of potash adhering to the end of it.

Fig. 21.

"Fig. 21. represents the form of this experiment, where *g* is the frog; *a*, *a*, the two glasses with water; A, the bow formed of one single metal, and *m* the drop or a thin stratum of a mucous, saline, &c. fluid, with which the bow has been rubbed over, and which on this side is between the metal and the water.

"The very considerable difference in regard to the quantity of effect in the before-mentioned experiments already shews, that if the electric stream excited by contact is strongest towards a certain metal, when that metal is placed between a certain fluid on the one side, and another fluid on the other, there are other fluids which produce a greater effect with another kind of metal; so that it will be necessary to discover by experiment the particular arrangement of conductors suited to each metal, in which the fluids or conductors of the second class must be disposed according to their activity. I have paid great attention to this circumstance, and have formed several tables, which I shall publish as soon as I have brought them to perfection.

"I shall here, however, only observe, that in order to class, in some manner, the innumerable different moist conductors of this kind, I distinguish them into aqueous, spirituous, mucous, and gelatinous, saccharine, saponaceous, saline, acid, alkaline, and sulphurous (livers of sulphur) liquids; that I make subdivisions in the acids down to the best known simple mineral acids, (as I find in this respect great difference between the nitrous and the muriatic acids), comprehending the principal vegetable acids and the acids of galls; and do the same in regard to the saline fluids, according as they are solutions of neutral salts, earthy salts, and particularly metallic salts.

"When it can be determined in what order all these kinds of fluids follow each other, in regard to the power in question, for the metal A, and another for the metal B, &c. we shall then be in a condition to determine what place must be assigned to a great number of other heterogeneous fluids, whether mineral, vegetable, or animal, which belong to several of the above classes. In general, the order for the greater part of the metals hitherto observed is as follows: 1st, pure water; 2d, water mixed with clay or chalk (which shows a pretty different effect when the before-mentioned experiment is made with two glasses, a bow of tin or zinc, and a properly prepared frog, which has a sufficient degree of vitality); 3d, a solution of sugar; 4th, alcohol; 5th, milk; 6th, mucilaginous fluids; 7th, animal gelatinous fluids; 8th, wine; 9th, vinegar, and other vegetable juices and acids; 10th, saliva; 11th, mucus of the nose; 12th, blood; 13th, brains; 14th, solution of salt; 15th, soap-suds; 16th, chalk-water; 17th, concentrated mineral acids; 18th, strong alkaline leys; 19th, alkaline fluids; 20th, livers of sulphur. With some metals there is, however, a considerable deviation from this order, in regard to livers of sulphur, alkaline fluids, and the nitrous and saline acids.

"As to the metals, which in their position between these different fluids are more or less proper for the electric effect in question, I have found in general, that tin exceeds all others, and that silver is the worst; except when one of the fluids betwixt which the silver is placed is water, or any other aqueous conductor, and the other liver of sulphur: in this case silver far exceeds zinc, and even tin. Iron also produces a much greater effect than any other metal, when it is in contact, on the one side, with mere water or an aqueous conductor,

conductor, and on the other with the nitrous acid, were it even only a drop. The excitement occasioned in both cases is wonderful; since it exceeds, as I have already remarked, that produced, according to the usual method, by means of a double metallic bow, even of different metals, as zinc and silver, applied to conductors of the second class of the same kind. It is sufficiently strong and powerful to produce convulsive movements in a half-prepared frog, the bowels of which have not been taken out, when one of the two moist conductors is a concentrated alkaline solution, and the metal placed between them is zinc, or rather tin. With other metals and other fluids you can seldom produce convulsions in a frog, if it be not perfectly prepared, or at least embowelled.

"The reader will readily perceive, that when a bow of one and the same metal touches with both its ends the same kind of saline water, the same acid, the same alkaline fluid, &c. an electric steam will not take place, as happens also when it touches on each side merely water: in that case two opposite actions are opposed to each other, and keep each other in equilibrium. That these contrary powers, however, may be in perfect equilibrium, it is necessary that the fluids applied to both ends of the homogeneous metalline bow be exactly of the same kind and of the same strength. For this reason the most careful attention and a certain dexterity are required, in order to ensure success to the experiment, which I have often performed to the great astonishment of the spectators, and which any one may repeat as was done by my friend Humboldt. That philosopher has already published some of the most striking and decisive of these experiments in his second letter; and I shall here give a more particular account of them.

"Having placed a completely or only half-prepared frog as usual in two glasses of water, take a very clean bow of silver (it will be best when it has been washed with water from the glasses), and immerse both ends of it at once, or the one after the other, in the glasses; no agitation of the frog will be occasioned. Repeat the experiment, after you have daubed over one end of the bow with the white of an egg, liquid glue, saliva, mucus, blood, a solution of tartar, or any other fluid or conducting substance sufficiently different from pure water. First, immerse the pure end, or that moistened merely with water, in the water of one of the glasses; and afterwards the other end, daubed over with the above substances, in the water of the other glass; you will then infallibly produce a convulsive movement in the frog, and several times in succession, if you draw out the bow and again immerse it until nothing more of the above substances is left adhering to the metal, or until the metal, with its ends in both the glasses, touches only pure, or nearly pure, water. Daub both the above substances uniformly over both ends of the bow, and immerse them at the same time in both the glasses of water, and no convulsions will arise. They will often be produced in newly prepared and highly irritable frogs, when the saline fluid, or, in general, the substance with which the two ends of the bow are daubed over, is not perfectly the same, or when the substance at the one end is more diluted than at the other, &c. Wash and clean carefully the one end of the bow, daub over the other more or less, and convulsions will be again produced as soon as the circle is made complete by the double immersion of the bow. Clean both ends completely, and no agitation will arise, as in the first experiment.

"For comparative experiments of this kind, I would recommend viscous fluids or substances rather than saline, because the latter are too soon dissolved in the water. It oft-times happens that the convulsions of the frog, when it is completely prepared and highly irritable, take place, though both ends of the metallic bow are daubed over with the same kind of saline fluid. The cause of this is, that when one end is immersed in the water after the other (and it may be easily seen that it is impossible to do so in a moment with sufficient accuracy), the one end of the bow loses a portion of its saline substance sooner than the other, or at least the adhering part is more diluted by the water, so that the fluid with which both ends have been daubed over is no longer the same.

"For these experiment I would also recommend silver, as a metal that is less liable than others to be attacked and changed by saline and other liquids. Tin, lead, copper, and in particular iron, are more susceptible of lasting variations; so that bows of these metals, and of iron above all, retain for a long time the power of producing convulsions in a newly prepared and highly irritable frog, even when both the ends of the bow are immersed in two glasses of water, although the places of the metal, attacked by any of the saline fluids, have been carefully washed and cleaned. A superficial alteration in the metal is sufficient to produce this change, as may be easily seen. These variations often shew themselves to the eye by a yellow blackish spot, &c. which it is difficult to remove. I do not here speak of lasting variations, that proceed to a greater depth, which can be produced in the end of the metallic bow, and particularly in iron, when its hardness is changed; a process by which such a bow can be rendered capable of producing not only convulsions in frogs, but also a particular sensation on the tongue, and light before the eyes, if both its ends, made perfectly clean, are only brought into contact with pure water. These, and many other experiments of the like kind, form the chief subject of my first letter to the abbe Vassali, professor of natural philosophy at Turin, written in the beginning of the year 1794, and afterwards published with the other in Brugnatelli's Journal.

"If silver be less exposed to be attacked by saline and other fluids (except by liver of sulphur, which instantaneously renders it black); if it be less susceptible of considerable and lasting variations, and has therefore this advantage over other metals, that it is liable to fewer irregularities; tin, on account of its greater activity, that is, the strength of the effects which it produces by being brought into contact with almost all moist conductors, as I have already observed, is to be preferred to silver, and in a certain degree to all other metals. The experiment I have already described with a tin bason filled with an alkaline fluid, and held in the hands moistened with water, by which an acid sensation is excited on the tongue when brought into contact with the above fluid, is a proof of it; for it would be vain to expect a like effect from a bason of lead, iron, or copper, and much more so from one of silver. With the latter it would be obtained only when it contained

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tained liquid liver of sulphur; and in that case the acid taste would be pretty strong.

"The electric fluid is excited also with the greatest strength and activity, when the metal is tin, between water and a saline fluid: but it will be excited with still greater energy to produce an acid sensation on the tongue when the tin is between water and an insipid mucilaginous fluid; or when the experiment is made with a tin bason filled with a solution of gum, liquid glue, white of an egg, &c. The other metals, in like circumstances, produce some effect, but much weaker: silver produces the weakest, except with liver of sulphur, as I have already observed.

"A like experiment, which I made three years ago, and exhibited to various persons, not with two different fluids and one metal, as in that above described, but contrariwise, with two metals of a different kind and a fluid, is already known. I took a bason of tin (one of zinc is better), placed it on a silver stand, and filled it with water. When any of the persons in company applied the tip of his tongue to the water, he found it perfectly tasteless as long as he did not touch the silver stand; but as soon as he laid hold of the stand, and grasped it in his hands well moistened, he experienced on the tongue a very perceptible and pretty strong acid taste. This experiment will succeed, though the effect is proportionably weaker, with a chain of several persons who hold each other's hands, after they have been moistened with water, while the first applies the tip of his tongue to the water in the bason, and the last lays hold with his hands of the silver stand.

"If these experiments, in regard to the taste excited on the tongue by the action of two different metals, are striking, the others, in regard to the taste excited, modified and changed by one metal between two different fluids, are no less so, and they are also newer. They are still interesting on this account, that they discover to us the cause of that taste often perceived in water and other liquids, which is more or less considerable or various when drunk from vessels of metal, and particularly of tin. When the outer extremity of the vessel is applied to the under lip, rendered moist by the saliva, and the tongue is extended so as to be in contact with the water, beer, wine, &c. in the vessel, or when the tongue is bent as is done in drinking, is there not then a complete circle, and is not the metal between two more or less different liquids, that is, between the saliva of the under lip and the liquor in the cup or vessel? A stronger or weaker electric stream must thereby be occasioned, according as the fluids are different—a stream which will not fail in its way to affect the sensible organs of the tongue in the said circle.

"Besides the two methods already considered, of producing an electric current, that is, by means of one or more moist conductors, or conductors of the second class, placed between two different metals or conductors of the first class; or contrariwise by means of a conductor of the first class placed between two of the second class, also different; there is still a third method of exciting the electric fluid, though in a degree so much weaker, that it is scarcely capable of causing convulsions in a perfectly prepared frog, in which there is still a strong degree of vitality. This new method consists in forming the circle of three different conductors, all of the second class, without the intervention of one of the first or a metal one. Some think they find in this method a strong objection against my principle.

Fig. 22.

Fig. 22. represents this third method compared with the other two. In the experiments of Professor Valli, respecting which so much noise has been made without any reason, *t* represents the leg of the frog, and particularly the hard tendinous part of the *musculus gastrocnemius*; *m* the rump, or the muscles of the back, or the ischiatic nerves, to which the said tendinous parts are applied; and *a* the blood, or the viscous saponaceous or saline fluid, applied to the point of contact.

"I have fully described this new method, where no metal is used, in my third and fourth letter to Professor Vassali, written in the autumn and winter of the year 1795. I have there shewn, that these new facts, far from altering my ideas and principles, serve rather to establish them; and that they render more general the principle that the conductors, by heterogeneous contact, that is, of two different from each other, become exciters of electricity, and confirm the beautiful law arising from it, that to produce an electric stream, the circle must necessarily be formed of three different conductors. You now see in what the whole secret, the whole magic consists; and that it depends not merely on metals, as might have been believed, but on all the different conductors. As long as we adhere to these principles, it will be easy to explain all the before-mentioned experiments without being reduced to the necessity of having recourse to any imaginary principle, or any peculiar and active electricity of the organs. By their assistance you will be enabled to invent new experiments, and to foretel the result of them, as I have several times done, and still do daily. If you, however, abandon these principles, you will find nothing but uncertainty and contradiction, and the whole will be an inexplicable problem.

"Some new facts, he observes in a farther communication, lately discovered, seem to shew that the immediate cause which excites the electric fluid, and puts it in motion, whether it be an attractive or a repulsive power, is to be ascribed much rather to the mutual contact of two different metals, than to their contact with moist conductors. But, though it cannot be denied, that in the latter case there exists an action, it is proved that it exerts itself in a far more considerable degree when the two metals mutually touch each other. There arises by the mutual contact, for example, of silver and tin, an action or power by which the former communicates the electric fluid, and the latter receives it; or the silver suffers it to escape, and the tin attracts it. This produces, when the circle is rendered complete by moist conductors, a stream, or continual circulation of the fluid. When the circle is complete, there is an accumulation in the tin at the expence of the silver; which indeed is very small, and far under the point necessary to enable it to announce itself by the most delicate electrometer. I have however been able, by the assistance of my condenser, constructed on a new plan, and still better by NICHOLSON's doubler, to render it very perceptible: I shall here communicate the result obtained by my experiments, which I made some time ago with great satisfaction.

"*Experiment* I. The three plates of the doubler are of brass. I took two strong wires, one of silver and the of the other of tin, and brought the former into contact with the moveable plates, and the other with one of the fixed plates; while they both rested on the table, or, what is better, on moist pasteboard, or any other moist conductor, so as to be in communication by the intervention of one or more conductors of the second class. I suffered the apparatus to remain some hours in this state, then removed the two wires, and put the machine in motion. After 20, 30, or 40 revolutions (or more when the atmosphere was not dry, or the insulation imperfect), I brought one of my straw electrometers into contact with the moveable plate, and observed indications of positive electricity (+E), which arose to 4, 6, 10 degrees, and more. If I suffered it to touch the fixed plates, I had the corresponding indications of the opposite kind of electricity (—E).

"The silver, therefore, poured the electric fluid into the brass plate, when it had been some time in contact with it; and the tin attracted it from the other plate, which was also of brass, while in contact with it. This was confirmed by the following experiment, which is a real *experimentum crucis*.

"II. I reversed the experiment, so that the silver was in contact with one of the fixed plates, and the tin with the moveable one. The electricity which I obtained from the latter, after the apparatus had remained a sufficient time in that position was negative (—E); while that of the fixed plate was positive (+E).

"III. I applied only the tin wire to the moveable plate, and insulated the two fixed ones, or brought them into communication with the table or any other moist conductors with which the tin wire was in contact. This simple contact of the tin with the brass of which the moveable plate consists, is sufficient to excite in it a very small degree of negative electricity; only a longer time is required.

"Those acquainted with the action of electric atmospheres, and the construction of the doubler, will need no farther explanation, to enable them to comprehend the mode of action of this very ingenious instrument; how the electricity, once obtained from the moveable plate, must occasion an opposite kind in the fixed plate, and *vice versa;* how the opposite kinds of electricity are increased by each revolution of the machine, &c. In the present experiment, therefore, when the moveable plate is —E, the fixed plate must be +E.

"IV. This is the reverse of the former. The piece of tin was applied to one of the fixed plates, and the metallic one was insulated from all metallic contact. The result was now reversed; that is, the fixed plates were electrified negatively, and the moveable one had positive electricity.

"All these experiments succeed much better, and in a shorter time, if, during the mutual contact of the different metals, the moveable plate be opposite to either of the other two that are fixed; but still better when a piece of thick paper, such as a card, not moist, and of a thickness equal to the intermediate space, is placed between the two plates that stand opposite to each other. It is of advantage to leave the card some time in its place, and not to remove it till the moment when the metals in contact are removed and the machine put in motion. To render the insulation com-

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plete, and make the contact of the metals immediate, without the least moisture, which would be highly prejudicial, it will be proper to place the apparatus in the sun. Half an hour, and often less, will then be sufficient to obtain the required electricity, &c.; whereas, in other cases, several hours are necessary before the desired resnlt can be obtained. This experiment is represented in fig. 23. 24. 25. and 26. LLL (fig. 22. and 23.) are the three brass plates of the doubler; A the piece of silver which is in contact with one of these plates; E the piece of tin applied to the other plate, which is opposite to the former; *a a*, the moist conductor, or chain of moist conductors which form a communication with the pieces of metal. When the silver, as in fig. 23. is in contact with the anterior moveable plate, it gives up to it a little of the electric fluid, and the latter accumulates as much of it as possible; consequently the electricity of the plate becomes positive, as the sign + of the plate shews: whereas the tin attracts the electric fluid from the corresponding fixed plate, which by these means has negative electricity, as the sign (—) of the plate indicates; and it even communicates this electricity to the other fixed plate, which therefore has the sign (—) also.

Fig. 23.

"In fig. 24. every thing is reversed: the moveable plate is negatively electrified (—E), while the two fixed plates become positive (+E).

Fig. 24.

"Lastly, in the 25th and 26th figures, it is seen that the tin abstracts the electric fluid from the brass plate with which it is in contact. This plate is therefore negatively electrified, or has — E; and by the action of its atmosphere occasions positive electricity (+E) in the other plate standing opposite, which is in communication, either with the third plate, as fig. 25. or, what is still better, with other conductors, as fig. 26. These opposite electricities increase afterwards with each revolution of the machine; the action of which, according to the theory of electric atmospheres, produces this effect to the degree mentioned, and justifies the appellation of doubler of electricity, which has been given to this instrument.

Fig. 25. & 26.

"I now come to the experiments, which shew that we are to seek for the cause which calls forth the action of the electric fluid; which excites it, of whatever kind it be; determines its transition, &c. much rather in the mutual contact of the metals, than in the contact of the moist conductors with these metals. Though, according to every circumstance, we must admit some action of this kind in the latter contact, it cannot be denied that the former is certainly the most effectual. At present I shall only mention the two following experiments, which I contrived in such a manner that they may serve to explain a question of this kind.

"V. I left the two fixed plates of brass without making any alteration; took off the third moveable plate, and supplied its place by one of tin; and arranged the machine in such a manner, that the latter stood opposite to one of the other two plates. I then applied to this tin plate a bit of brass, and to the opposite fixed plate of brass a piece of tin. After a convenient time, (for example an hour, when the weather was perfectly dry), I took away the two pieces of metal, or only that of brass, and made the moveable plate of tin, which

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which was in contact with the piece of brass, to revolve about 30 times. It then gave me very perceptible marks of positive electricity.

"VI. I reversed the former experiment, and made the piece of brass touch the brass plate, and the piece of tin the plate of the same metal. I, however, obtained nothing, or almost nothing; even when the apparatus was left a much longer time in that situation, and when the machine had made twice or three times as many revolutions.

Fig. 27.

"These two experiments are represented by fig. 27. and 28.; where L is the piece of brass, E that of tin, and *a a* the moist conductors which connect the two different pieces of metal.

Fig. 28.

"In the arrangement of fig. 28. the same contact of different metals, viz. brass on the one side, and tin on the other, with the same kind of moist conductor, takes place, as well as in the preceding experiment of fig. 27. The addition of the electric fluid in the one, and the abstraction of it in the other, ought therefore equally to take place, though in an inverted order, when the action on the fluid calls forth the moving power, by this contact of the two metals, L, E, with the moist conductor between them; and yet this is not the case, as no signs of electricity are obtained even after a long time, and when the machine has been caused to make twice or three times as many revolutions. The condition essentially necessary to obtain electricity is, that the different metals must be in contact with each other, which is the case in fig. 27. but not in fig. 28.

"When the machine has been repeatedly turned, something may be obtained. This arises either from small remains of old electricity, which could not be destroyed or dissipated in the time during which the arrangement of fig. 26. was continued; or even from fresh electricity, which the moveable plate may have obtained from the atmosphere or vapours during the pretty considerable time of the machine being in a state of revolution; or some accidental difference, either between the two tin or the two brass pieces, may be the cause of some action on the electric fluid, or of some derangement in regard to the equilibrium. In the last place, the contact of the moist conductor with the tin on the one side, or with the brass on the other, may have a different action, which, in my opinion, must be very small, but yet is not entirely without effect.

"As it is now proved that, according to the arrangement of the sixth experiment, nothing, or almost nothing, is obtained by 40, 60, and even 80 revolutions of the doubler, while a great deal is obtained by that of the fifth with 20 or 30, we must therefore conclude that the contact of two metals of a different kind with moist conductors, without the mutual contact of these metals themselves (which is wanting in the sixth experiment, where brass is in contact with brass, and tin with tin), produces nothing, or almost nothing; and that, on the contrary, the mutual contact of the two metals of a different kind, which takes place in the fifth experiment, produces the whole, or almost the whole effect *."

* Phil. Mag. vi. 59, 163, 506.

32 Experiments of Fowler.

Dr Fowler instituted an elaborate series of experiments on this subject, in which he confirmed and extended many of the results which had been already obtained in the experiments and investigations of other naturalists. He found that metallic substances were the best agents or conductors, and he concluded that the contact of two dissimilar metals is an essential condition in the production of the phenomena of galvanism. It did not indeed escape his observation, that in some cases a single metal produced muscular contraction, but this he ascribed to mechanical stimulus, which excited a painful sensation in the animal, not quite dead, or to the impurity of the metal, containing some portion of alloy, or solder. Future observations, however, proved that these motions could be produced without any metal whatever. He found that the most powerful effects were produced by employing zinc, in combination with gold or silver. By means of these metals he produced contractions twenty-four hours after they had ceased. In the experiment by which this was established, the nerve was coated with tin, and a different metal was employed to complete the circle between the coating and the muscle. The same philosopher also found that the effects were increased in proportion to the bulk of the metals employed, and the extent of surface brought into contact; that a communication might be formed between the metals in contact, and the nerves of the animal which were exposed, by means of water; and that the temperature of the season and the nature of the animal's death seemed to have considerable influence on the duration of the phenomena. In many cases he was able to produce contractions in a frog, after three days had elapsed from the time that the head had been separated from the body. He seems to have directed his attention particularly to the conducting power of the substances employed in galvanic apparatus, and in tracing the analogy between this property and electricity. Although metals were found to be good conductors, this was not the case with the metallic oxides, or with the salts which have these oxides for their basis.

An earth-worm placed on a circular piece of zinc, exhibited contractions similar to those produced in living frogs, when a piece of silver was brought in contact to complete the circle. Worms of the same kind, suspended across a silver rod, and the head and tail being at the same time brought into contact with a piece of zinc, sustained a shock which seemed to pass through the whole body. A similar experiment, followed by the same result, was made on leeches. If an earth-worm or leech be placed on a piece of silver, resting on a plate of zinc, the animal experiences a painful sensation, when any part of its body comes in contact with the zinc. It seems to have the same disagreeable sensation when it is placed on the zinc, and any part of the body is brought into contact with the silver.

The inquiries of the same philosopher were also directed to ascertain whether the nerves in general are all equally subject to the galvanic influence, or whether its effects are limited to those which are subject to the power of the will. With this view the heart of a cow was separated from the body, soon after the animal was killed, and prepared in the way which has been already described, in the preparation of frogs; and while the contractions of the auricles still continued, the intercostal nerve being coated, and the apparatus arranged, the metals were brought into contact, but seemed to have no effect whatever on the contractions while they continued, and after they had ceased, had not the power of renewing them. He failed in many similar attempts on hot-of hot-blooded animals, but succeeded in producing muscular contractions in part of a frog, after an hour had elapsed from the time that the natural motions had ceased. He made a similar experiment on the heart of a cat which had been drowned in warm water, and he found that in this case the motion of the heart could be excited by means of galvanism; but when the animal was drowned in cold water, no effect could be produced.

It was another object of his investigations, to ascertain the effects of galvanism on the organs of the senses. The disagreeable taste which remains on the tongue, when two dissimilar metals, the one placed on the upper surface, and the other touching the under surface, are brought into contact, has been already taken notice of, and the method of applying the metals particularly described. The strongest impression, it was observed, was produced, when gold and zinc were employed. He introduced a metallic substance of a different kind into each ear, and having formed a communication between them, he experienced a shock in the head when these two metals were brought into contact. A bit of tin-foil was placed on the point of the tongue; the rounded end of a silver pencil case was applied to the internal angle of the eye; and when the other extremity of the pencil case and the tin-foil on the tongue were brought into contact, he perceived a flash of pale light, as well as the metallic taste in the tongue which is produced in a preceding experiment. The flash seemed most vivid when gold and zinc were employed. A similar effect is produced by introducing one of the metals between the upper lip and the gum, and the other between the under lip and the gum, and retaining them in this position to bring the edges in contact: or, by inserting one of the metals into the nose, and placing the other on the tongue, to form the communication between them.

3[4] Experiments of Robison.

Similar experiments were made by the late Professor Robison of Edinburgh. He particularly observed, that the effects of the galvanic fluid were more sensibly felt when one of the conducting metals was placed on a wound, or on the nerve of a carious tooth. From the peculiar impression on the tongue on the application of gold or silver trinkets, he could ascertain whether any solder was employed about them.

In another experiment the same philosopher seemed to think that he had proved that the effect was produced even before the metallic conductors were brought into direct contact. A piece of zinc was introduced between the gums and cheek on one side of the head, and a piece of silver was placed in the same way on the other side of the head. A rod of zinc was then applied to the zinc piece, and a rod of silver to the silver piece on the different sides of the head; the extremities of these rods which projected from the mouth were then cautiously brought into contact; and, as soon as this was completed, a strong sensation was produced in the gums. But before the direct contact was made between the extremities of the rods, he perceived a flash of light which was repeated when the rods were again separated to a small distance from each other. It is scarcely necessary to add, that when the arrangement of the rods was reversed, the effects ceased; that is, when the zinc rod was substituted for the silver rod, and the silver one for that of zinc.

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35 Aldini's experiments on the body of a malefactor.

To the account of the experiments on animals now given, which were chiefly made on cold-blooded animals, we shall now add those of Aldini, the nephew of Galvani, which were made on the body of a man executed in London for murder. This man, who was executed on the 17th January 1803, was 26 years of age, and seemed to have been of a strong vigorous constitution. The body was exposed for an hour to a temperature two degrees below the freezing point Fahrenheit, at the end of which it was conveyed to a house not far distant, where the apparatus for the experiments had been arranged. The following is the account of these experiments in the author's own words.

" *Experiment* 1.—One arc being applied to the mouth, and another to the ear, wetted with a solution of muriate of soda (common salt), galvanism was communicated by means of three troughs combined together, each of which contained 40 plates of zinc, and as many of copper. On the first application of the arcs the jaw began to quiver, the adjoining muscles were horribly contorted, and the left eye actually opened.

" *Exper.* 2.—On applying the arc to both ears, a motion of the head was manifested, and a convulsive action of all the muscles of the face; the lips and eyelids were also evidently affected, but the action seemed much increased by making one extremity of the arc to communicate with the nostrils, the other continuing in one ear.

" *Exper.* 3.—The conductors being applied to the ear and to the rectum, excited in the muscles contractions much stronger than in the preceding experiments. The action even of those muscles furthest distant from the points of contact with the arc was so much increased as almost to give an appearance of re-animation.

" *Exper.* 4.—In this state, wishing to try the power of ordinary stimulants, I applied volatile alkali to the nostrils and to the mouth, but without the least sensible action; on applying galvanism great action was constantly produced. I then administered the galvanic stimulus and volatile alkali together; the convulsions appeared to be much increased by this combination, and extended from the muscles of the head, face, and neck, as far as the deltoid. The effect in this case surpassed our most sanguine expectations, and vitality might, perhaps, have been restored, if many circumstances had not rendered it impossible.

" *Exper.* 5.—I next extended the arc from one ear to the *biceps flexor cubiti*, the fibres of which had been laid bare by dissection. This produced violent convulsions of all the muscles of the arm, and especially in the *biceps* and the *coraco brachialis*, even without the intervention of salt-water.

" *Exper.* 6.—An incision having been made in the wrist, among the small filaments of the nerves and cellular membrane, on bringing the arc into contact with this part, a very strong action of the muscles of the fore-arm and hand was immediately perceived. In this, as in the last experiment, the animal moisture was sufficient to conduct the galvanic stimulus without the intervention of salt-water.

" *Exper.* 7.—The short muscles of the thumb were dissected,

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dissected, and submitted to the action of the galvanic apparatus, which induced a forcible effort to clench the hand.

" *Exper.* 8.—The effects of galvanism in this experiment were compared with those of other stimulants. For this purpose, the point of the scalpel was applied to the fibres, and even introduced into the substance of the *biceps flexor cubiti*, without producing the slightest motion. The same result was obtained from the use of caustic volatile alkali and concentrated sulphuric acid. The latter even corroded the muscle, without inducing it to action.

" *Exper.* 9.—Having opened the thorax and the pericardium, exposing the heart *in situ*, I endeavoured to excite action in the ventricles, but without success. The arc was first applied upon the surface, then in the substance of the fibres, to the *carneæ columneæ*, to the *septum ventriculorum*, and lastly, in the course of the nerves by the coronary arteries, even with salt water interposed, but without the slightest visible action being induced.

" *Exper.* 10.—In this experiment the arc was conveyed to the right auricle, and produced a considerable contraction, without the intervention of salt water, but especially in that part called the *appendix auricularis*; in the left auricle scarcely any action was exhibited.

" *Exper.* 11.—Conductors being applied from the spinal marrow to the fibres of the *biceps flexor cubiti*, the *gluteus maximus*, and the *gastrocnemius*, separately, no considerable action in the muscles of the arm and leg was produced.

" *Exper.* 12.—The sciatic nerve being exposed between the great trochanter of the femur and the tuberosity of the ischium, and the arc being established from the spinal marrow to the nerve divested of its theca, we observed, to our astonishment, that no contraction whatever ensued in the muscles, although salt water was used at both extremities of the arc. But the conductor being made to communicate with the fibres of the muscles and the cellular membrane, as strong an action as before was manifested.

" *Exper.* 13.—By making the arc to communicate with the sciatic nerve and the gastrocnemius muscle, a very feeble action was produced in the latter.

" *Exper.* 14.—Conductors being applied from the sciatic to the peronæal nerve, scarcely any motion was excited in the muscles.

" *Exper.* 15.—The sciatic nerve being divided about the middle of the thigh, on applying the conductors from the biceps flexor cruris to the gastrocnemius, there ensued a powerful contraction of both. I must here observe that the muscles continued excitable for seven hours and a half after the execution. The troughs were frequently renewed, yet towards the close they were very much exhausted. No doubt, with a stronger apparatus we might have observed muscular action much longer; for, after the experiments had been continued for three or four hours, the power of a single trough was not sufficient to excite the action of the muscles: the assistance of a more powerful apparatus was required. This shows that such a long series of experiments could not have been performed by the simple application of metallic coatings. I am of opinion that, in general, these coatings, invented in the first instance by Galvani, are passive. They serve merely to conduct the fluid pre-existent in the animal system; whereas, with the galvanic batteries of Volta, the muscles are excited to action by the influence of the apparatus itself.

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" From the above experiments there is reason to conclude,

36 Conclusions from the

" 1. That galvanism, considered by itself, exerts a considerable power over the nervous and muscular systems, and operates universally on the whole of the animal economy.

" 2. That the power of galvanism, as a stimulant, is stronger than any mechanical action whatever.

" 3. That the effects of galvanism on the human frame differ from those produced by electricity communicated with common electrical machines.

" 4. That galvanism, whether administered by means of troughs or piles, differs in its effects from those produced by the simple metallic coatings employed by Galvani.

" 5. That when the surfaces of the nerves and muscles are armed with metallic coatings, the influence of the galvanic batteries is conveyed to a greater number of points, and acts with considerably more force in producing contractions of the muscular fibre.

" 6. That the action of galvanism on the heart is different from that on other muscles. For, when the heart is no longer susceptible of the galvanic influence, the other muscles remain still excitable for a certain time. It is also remarkable that the action produced by galvanism on the auricles is different from that produced on the ventricles of the heart, as is demonstrated in experiment the tenth.

" 7. That galvanism affords very powerful means of resuscitation in cases of suspended animation under common circumstances. The remedies already adopted in asphyxia, drowning, &c. when combined with the influence of galvanism, will produce much greater effect than either of them separately *."

* p. S.

Excepting the experiments of Aldini which we have just detailed, the greater number of those of which an account has been given, it has been already observed, were made on cold-blooded animals, and besides, the apparatus usually employed, was a single galvanic combination. After the construction of the pile was known, and still more so after batteries in the form of troughs were invented and employed, very different effects were exhibited on the animal body, both in the dead and living state.

With batteries composed of 200, 300, or 400 pairs of plates arranged in troughs, very powerful shocks will be felt when the circle is completed between the extremities of the battery by means of the two hands of any person, so that the fluid shall pass through the body. This experiment may be performed by touching with one hand wetted, a wire connected with one extremity of the battery, and with the other hand also moistened a wire proceeding from the other end of the battery. Every time that the contact is made a shock is felt. The effect will be more powerful if round balls of brass having brass rods attached to them after being well wetted, be placed in the palms of the hands also well wetted, and a communication be established between the ends of the battery. The same effect is produced when the circle is completed by means of a number of persons joining hands together; but it must be observed, that each person must take care to have the

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the hands well moistened, otherwise the intensity of the shock will be greatly diminished, or its effect entirely obstructed. No experiments have been made, so far as we recollect, to ascertain with any degree of precision, how far the intensity of the shock is diminished by increasing the number of persons composing the circle of communication, or whether, indeed, when the experiment is made with the requisite degree of caution and attention, it suffers any diminution.

7 Galvanic shock compared.

It has been observed by some, (and so far as we can judge from our own feelings in numerous experiments made with a pile composed of 60 pairs of plates, or with a trough of 50 pairs, and sometimes with two and four troughs of 50 pairs each combined, the observation which we have made coincides with that of others), that the shock from the galvanic battery possessed some peculiarity, by which the sensation it excited was much more disagreeable than a shock of artificial electricity which seemed to be of no greater intensity. But it must be allowed, that in the comparison of experiments of such delicacy, the result of which depends on the feelings, great ambiguity must prevail; and therefore, when the comparison is unavoidably so inaccurate, it can afford no precise conclusion.

8 Effect on wounds.

The sensation is extremely unpleasant when the shock of galvanism, even when it is very slight, passes through the fingers, if they have been scratched or wounded.

9 Directed through the head.

A slight shock directed through the head between the temples, produces the sensation of a flash of light before the eyes, and an irresistible contraction of the muscles of the upper eyelids, so that the person who is the subject of the experiment involuntarily winks every time that the circle is completed. This experiment, which should be repeated with caution, is performed in the following manner: Place a bit of tin-foil which will adhere by wetting with water to the part to which it is applied, on each temple. Then having formed the communication between one end of the trough and one temple by means of a metallic conductor, flat like a small button, in that part which touches the tin-foil; this is retained in contact with the tin-foil by an assistant; and by means of another assistant, another similar conductor is applied to the tin-foil on the other temple. Things being thus arranged, the wire connected with the latter, is by the operator brought in contact with the other extremity of the battery, or with that part of it to which the extent or intensity of the shock is to be limited. Every time that this contact is repeated, the sensation of the flash of light, and the other effects, are produced. It has been hinted above, that this experiment should be performed with caution.

Cautions.

Not more than from 12 to 20 pairs of plates should be employed, at least on those on whom the effects of a small number have not been previously tried; and perhaps with that number, at least in the experiments of this kind which we have seen made, there are not many persons who would choose to have them repeated on themselves. But these effects, it may be added, will be more or less powerful in proportion to the period that the battery has continued in action with the same fluid.

Effect on dead animals.

A battery composed of 200 pairs of plates will produce strong contractions in the limbs of a fowl or rabbit, which has been recently killed. These effects may be conveniently exhibited by introducing one of the conducting wires, by means of a hook, into the mouth, or fixing it about the back part of the head of the animal, and fixing a similar hook from another wire connected with the other end of the battery near the rump, so that the current of galvanic fluid shall pass through the body. When the communication between the extremities of the battery is formed, the convulsive motions of the limbs of the animal take place, and are repeated as often as the circle is completed. Similar effects are produced on a dog or sheep; but to induce strong convulsions in the larger animals, a more powerful apparatus must be employed. It will be necessary to put in action a battery consisting of at least 300 or 400 pairs of plates arranged in troughs.

With a battery of such extent and power, the convulsive motions produced on the limbs of horses that were subjected to its action, were so strong that they could scarcely be resisted by the strength of two persons.

The head of an ox, soon after it was separated from the body, and while it was yet warm, was acted on by six batteries, amounting to about 300 pairs of plates. Strong convulsive motions were produced; the eyes opened, and the pupils were greatly dilated; the ears were also put in motion; and the tongue, drawn out and fixed to the table with an iron skewer which entered the wood above half an inch, was retracted with such force as to detach itself from the skewer which was thrown to some height into the air.

It has been said that the motions thus induced on the limbs of animals by means of galvanism, resemble the convulsive motions of epilepsy. Perhaps the motions of animals during the struggles of death may be considered as nearly similar. Whether this be so or not, we have observed that the convulsive contractions of animals subjected to galvanism, greatly resemble the peculiar motions of each animal in the struggles of death. This observation, however, only extends to what has happened to fowls, rabbits, and sheep; but so far as it goes, it has been allowed by those to whom we have remarked the circumstance to be pretty correct.

With these observations we conclude this long detail of the effects of galvanism on animals. This seemed to be necessary in order to give the reader a distinct view of what may be considered as the dawn of this department of science; for as we have already hinted, the experiments and investigations of naturalists were at first limited to its effects on animals; and from their labours an immense body of facts were accumulated before its chemical effects were much known or distinctly ascertained. We now therefore proceed to the consideration of the chemical effects of galvanism. These shall be the subject of the next chapter.

Chap. III. *Of the Chemical Effects of Galvanism.*

In the account we propose to lay before our readers, of those effects of the galvanic fluid which are to be considered as more strictly chemical, we shall first state more generally some of the experiments by means of which these effects are illustrated, and describe the method of performing them, and then enter into a more particular detail of the experiments of different philosophers which tended to improve and enlarge the knowledge of galvanism.

We shall limit the account of the experiments first alluded to above to the combustion of charcoal, the deflagration and combustion of metallic substances, the decomposition of water and some other fluids, and the precipitation of metals from their solution in acids.

42 Combustion of charcoal.

Exper. 1.—With a battery composed of 50 pairs of plates of three or four inches square, with proper management, a brilliant light may be produced from the combustion of charcoal. The charcoal for this experiment should be well prepared from some of the harder woods, such as beech or boxwood. It has been said that it could only be properly prepared by exposing it to a degree of heat equal to that of a glasshouse furnace; but we know from experience that so high a temperature is by no means absolutely necessary. We have prepared charcoal which was found to answer the purpose of the present experiment, with such a heat as can be easily commanded in a small chemical furnace. The wood which is to be converted into charcoal is divided into slips of about one-fourth of an inch square; it is then put into a crucible, which is filled up with sand, and may be covered with another crucible inverted, so as still more effectually to prevent the access of air. The crucible is then placed in the middle of the furnace, which is to be filled up with charcoal, and a strong heat maintained for eight or ten hours. After this the charcoal will be found sufficiently prepared, and this is of some consequence to be attended to, because on the complete conversion of the wood into this state much of the experiment depends.

Slips of charcoal reduced to a fine point are attached to wires, which communicate with the extremities of the battery. The charcoal may be fixed to the conducting wires by means of a bit of thread, or fine iron or brass wire, or they may be fixed in pincers, or an instrument similar to that which is used for holding crayons or black-lead penils; but in whatever way this part of the apparatus is contrived, when the two pieces of charcoal connected by means of metallic conductors with the extremities of the battery are brought into contact, combustion immediately takes place. The rapidity or brilliancy of this combustion is proportioned to the strength and activity of the battery. The light produced by such a battery as that we have described above, will be at times pretty vivid; but with two such batteries whose action is combined, it is still more brilliant. When four batteries, consisting each of 50 pairs of plates of eight inches square, are employed for this experiment, nothing perhaps can exceed the brilliancy of the light which is given out during the combustion of the charcoal. With the smaller battery, the process is occasionally interrupted; but with the larger apparatus the combustion goes on for a short time, giving out a continued and uniform brilliant light. When this is the case, the rays seem to proceed from the point where the combustion is going on, and exhibit all the variety of the prismatic colours. When the pieces of charcoal are immersed in water, and brought into contact under its surface, the combustion also goes on with considerable rapidity.

43 Of metals.

Exper. 2.—The deflagration and combustion of many metallic substances may be also effected with a battery composed of 50 pairs of three inch plates, and this may be done with a very simple apparatus. A bent wire, such as we have already described, is inserted into the perforated projecting piece of wood, at the extremity of the battery. The wire is to be bent at a right angle to that part of it which is fixed perpendicularly into the extremity of the trough, and on the horizontal part of it is placed the metallic substance to be deflagrated. A plate of copper, which must be perfectly clean and free from oxide, is to be connected with the other end of the battery by means of a conducting wire. When the apparatus is thus arranged, if the copper plate be brought into contact with gold or silver leaf, for instance, the combustion of these substances will take place, and this combustion, it is scarcely necessary to add, will be in proportion to the power of the battery and its energy. In the same way tin-foil, white and yellow Dutch metal, as it is called, may be subjected to experiment, and with a battery of moderate power, a brilliant combustion may be produced.

When a battery of greater power is employed, a very brilliant and rapid combustion of steel wire can be effected. This experiment is made by stretching a piece of wire, such as that which is used for the smaller strings of musical instruments, between the two metallic conductors connected with the opposite extremities of the battery; and thus completing the circle, the combustion takes place. When the experiment succeeds, several inches of the wire are almost instantaneously reduced to the state of oxide. In this way the energy of the battery may be in some measure ascertained, as it must be in proportion to the length of the wire which is burnt. When a very powerful battery is in action, 10 or 12 inches of such wire may be completely burnt, that is, not merely made red hot, but having undergone the process of combustion, and having passed from the metallic state to that of oxide.

44 Decomposition of water.

Exper. 3.—We have already described the apparatus for the decomposition of water. To exhibit this experiment, it is only necessary to fill some of the tubes which have been mentioned for this purpose with water, and to complete the circle of communication between the extremities of the battery, the water in the tube to be decomposed forming part of this circle. If the conducting wires terminating in the tube consist of metals which do not readily undergo oxidation, such as gold or platina, the gases which are the constituent parts of water are separated from the wires, the oxygen gas from the one, and the hydrogen gas from the other, and are seen rising in bubbles to the top of the tube, displacing a quantity of water equal to the space occupied by the gases evolved. This process goes on till the surface of the water falls below the conducting wire passing through the top of the tube; and the circle being then interrupted, the process stops. When this is the case, if the two conducting wires within the tube can by any contrivance be brought into contact, a spark is produced, by which the gases are set fire to, and are again converted into the state of water. This combustion is attended with an explosion. Or if the tube be carefully taken from the apparatus under water, while the finger is placed upon the open end, and then inverted, the gas collected will rise through the water; it may then be set fire to by means of a burning body, a similar combustion will take place, attended with an explosion.

But

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But if the wires terminating in the tube be of brass or iron, or any metal which is easily oxidated, only one of the gases is collected in the tube; the other (the oxygen) combines with the metal, forming an oxide, which collects on the point of the wire.

By a very simple contrivance the gases may be collected separately. With this view two tubes in which the conducting wires terminate, are employed. These tubes being filled with water, must be inverted in the same bason of water, the latter of which forms the communication between the extremities of the battery.

45 Other liquids decomposed.

Other fluids, as oil, alcohol, ether, and ammonia in solution, may be also decomposed by a similar process. For the decomposition of oil, alcohol, and ether, the pieces of charcoal may be immersed in vessels containing these liquids; and, when they are brought into contact, the decomposition is effected, with the formation and evolution of carbonic acid gas, which is seen rising in bubbles to the surface.

46 Precipitation of metals.

Exper. 4.—By means of galvanism, and with a battery of moderate power, metals may be precipitated from their solutions in acids. The apparatus to be employed for this purpose is similar to that for the decomposition of water, and the tube is filled with a solution of the metallic salt. The communication being then established, the metal is precipitated, and appears in an arborescent form on the point of the wire. In this way the acetate of lead, or sugar of lead, the nitrate of silver, and many other metallic salts, may be revived.

Many other curious and amusing experiments might have been related, but what we have now given will enable the reader to have a distinct notion of the chemical effects of galvanism. Many other of the chemical effects of the galvanic fluid are so closely connected with the peculiar views and theories of those who have discovered and observed them, that we shall not enter into any detail of them till we come to consider that part of the subject. In the mean time we shall occupy the remaining part of the present chapter with an account of some of the experiments on the chemical effects of galvanism which were observed by philosophers in the earlier part of its progress.

Mr Cruickshank, the inventor of the galvanic trough, very early directed his attention to this inquiry, and prosecuted it with great ardour and success. In one of his early communications on this subject we have a comprehensive view of some of the chemical phenomena of galvanism. We shall, therefore, give it in his own words.

47 Experiments of Cruickshank.

"I shall not, says he, give any particular account of the apparatus employed, being a pile, and not differing materially from that in use. I shall only just observe, that it consisted of plates of zinc and silver, of about 1.6 inches square, and that the number of each employed in the following experiments varied from 40 to 100, according to the power required.

"I found that a solution of the muriate of ammonia answered better for moistening the interposed papers than common water.

"When the machine was in full action, sparks which were perfectly visible in the day time, could be taken at pleasure, by making a communication in the usual way between the extremities of the pile, and a small report or snap could be heard; the shock given at that time was very strong, and a gold-leaf electrometer, placed in the circle of communication, was very sensibly affected: these circumstances, some of which, I believe, have been already ascertained by Messrs Nicholson and Carlisle, shew the strong resemblance of this influence to electricity. These gentlemen have likewise discovered that galvanism decomposes water with much greater facility than electricity, but with phenomena somewhat different.

"*Exper.* 1.—A quantity of common water was introduced into a glass tube, being confined at each end by corks, but perfectly at one by a cement of rosin and bees wax: pieces of silver wire were passed through the corks, and brought within an inch of each other in the fluid, their other extremities being at the same time connected with those of the machine or pile, one with the lower zinc plate, and the other with the upper silver plate. In future, to avoid circumlocution, I shall call the wire attached to the silver plate, the silver wire, and the other the zinc wire. The tube was then placed upright in a cup containing water, with the uncemented end downwards. As soon as the communication was made between the extremities of the pile by the wires, a quantity of small air bubbles began to ascend from the end of the wire connected with the silver, as observed by Messrs Nicholson and Carlisle; but a white cloud at the same time made its appearance at the one proceeding from the zinc, or the zinc wire. This cloud gradually increased, and assumed a darker colour, and at last it became purple, or even black. A very few air bubbles were likewise collected upon and ascended from this wire, but when the machine was in full force, a considerable stream could be observed.

"The gas was collected, and found to be a mixture of hydrogen and oxygen, in the proportion of three parts of the former to one of the latter. No great dependence, however, was placed upon this in point of accuracy. The zinc wire was found to be much corroded, and looked as if a considerable portion of it had been dissolved. As the cloud which was formed around this wire became purple on exposure to the light, I suspected it might be luna cornea, or muriate of silver proceeding from the silver, which had been somehow dissolved, and afterwards precipitated in this state, by the muriatic salts in the common water. This led to the following experiments:

"*Exper.* 2.—The glass tube was now filled with distilled water, to which a little tincture of litmus was added; when the communication was made by the wires as in the former experiment, a quantity of gas arose from both wires, but in the greatest quantity from that connected with the silver. In a few minutes a fine red line, extending some way upwards, was perceived at the extremity of the zinc wire; this increased, and in a short time the whole fluid below the point of this wire became red; the fluid, however, above the silver wire, looked of a deeper blue than before, the slight tinge of purple being destroyed.

"*Exper.* 3.—I next filled the tube with distilled water, tinged with the tincture of Brazil wood; it was no sooner placed in the circle of communication, than the fluid surrounding the silver wire, particularly towards its extremity, became purple, and this tinge increased so fast, that the whole fluid surrounding this wire, and occupying the upper part of the tube, soon assumed as deep a colour, as could be produced by ammonia.

"The portion of the fluid in contact with the zinc wire

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wire became very pale, and almost colourless, nor could the purple tinge extend below its upper extremity. From these experiments it would appear, that an acid, probably the nitrous, is produced at the wire proceeding from the zinc, and an alkali, probably ammonia, at that in contact with the silver. These facts sufficiently explain the action upon the silver wire, and the nature of the whitish cloud proceeding from it, and afterwards becoming purple. When lime water was employed instead of common or distilled water, the wire was likewise acted upon, but in a less degree, and the cloud had at first an olive colour, exactly resembling the precipitate of silver by lime-water.

"The quantity of silver dissolved or corroded, if I may use the expression, in these experiments, was very considerable, and where common or distilled water had been employed, a small portion of it remained in solution, which was discovered by the addition of the muriatic acid. Indeed a much larger quantity would probably have been suspended, had it not been for the alkali generated at the same time, and which manifestly produced a precipitate at, or near, the upper extremity of the zinc wire, where, after a certain time, a dark zone or stratum was always formed.

"*Exper.* 4.—It is a well known fact, that hydrogen gas when heated, or in its nascent state, reduces the calces of the metals; I expected, therefore, that by filling the glass tube with a metallic solution, I might be enabled to separate the hydrogen from the oxygen gas, and thus procure the latter in its simple or pure state. With this view the tube was filled with a solution of the acetite of lead, to which an excess of acid was added, to counteract the effects of the alkali. When the communication was made in the usual way, no gas could be perceived, but after a minute or two, some fine metallic needles were perceived at the extremity of the wire connected with the silver. These soon increased, and assumed the form of a feather, or rather that of the crystals of the muriate of ammonia. The lead thus precipitated was perfectly in its metallic state, and very brilliant; a little gas escaped from the wire connected with the zinc, and it was considerably corroded as usual.

"A solution of the sulphate of copper was next employed, and with the same result, the copper being precipitated in its metallic form by the wire connected with the silver. In this instance the metal did not crystallize, but formed a kind of button at the end of the wire, which adhered so completely to the silver, that it was found impossible to separate it.

"The most beautiful precipitate, however, was that of silver from its solution in the nitrous acid. In this case, the metal shot into fine needle-like crystals, articulated, or jointed to each other, as in the Arbor Dianæ.

"What became of the oxygen gas usually produced in these experiments?

"*Exper.* 5.—A quantity of pure water mixed with distilled vinegar was introduced into the tube, and placed in the circle of communication; some gas was disengaged from the silver wire, but no cloud appeared at the extremity of the zinc. After some time, however, a quantity of metallic silver was precipitated by the silver wire, and this precipitate at last became very copious; a perfectly similar effect was produced, when the tube was filled with very diluted sulphuric acid; in these cases the precipitated silver had the appearance of shining scales, like that thrown down by copper in the usual way. It may be proper to observe, that in all these precipitations and reductions, nothing but wires of pure silver were employed. The results in this last experiment were exactly what was expected; the vinegar prevented the alkali from precipitating the silver, dissolved by the generated acid; in consequence of which, when a sufficient quantity of the metal was taken up, it was again thrown down by the silver wire in its metallic form.

"*Exper.* 6.—A solution of the muriate of ammonia being introduced into the tube, and exposed to this influence, a little gas was disengaged from the silver wire, while the zinc one was incrusted with a substance which soon became black, and was found to be luna cornea. The liquor which remained in the tube, after the operation had been finished, was highly alkaline, and smelled strongly of ammonia; common salt was decomposed in a similar manner. This experiment accounts for the decomposition of the muriate of soda and ammonia, which always takes place when the papers in the pile are moistened with a solution of these salts.

"A solution of the nitrate of magnesia appeared to be likewise decomposed by this process; for after some time, a white powder resembling magnesia, was precipitated on the surface of the silver wire, very little gas was disengaged.

"*Exper.* 7.—In order to ascertain how far this influence might be carried, provided the circle of communication was complete, two tubes were employed, and connected by a silver wire passing through corks; the tubes were filled with water and secured by corks; two other wires being then passed through these corks, the arc was connected with the silver, and the other with the zinc, at the extremity of the pile. A quantity of gas as usual was disengaged at the extremity of the silver wire, and the portion of the connecting wire in the same tube was partly dissolved, and as mentioned in experiment 1st; but the other portion of the same wire in the other tube gave out gas, while the communicating zinc wire was corroded. And I make no doubt that a similar effect would be produced, if any number of tubes were connected in a similar manner, by which means a large quantity of gas might be procured in a short time.

"Besides silver wires, I likewise employed those of copper or iron, and it did not appear that these were more corroded or acted upon than the silver; indeed, in some of the above experiments, not less than half, or three-quarters of an inch of the wire was entirely consumed. The copper wire connected with the zinc gives out a greenish blue substance resembling the nitrate of copper with excess of the metal, or when part of the acid has been expelled by heat, &c. In examining the gas which was procured at different times, I always found it mixed with a little oxygen gas, but sometimes this did not exceed one-eighth of the whole in bulk; however, I paid but little attention to this part of the process, for as my wires were always corroded, no conclusion with regard to the composition of water could be drawn from it *."

We might have here detailed a great variety of experiments,

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periments, which have been made to ascertain the chemical effects of galvanism, and to elucidate the nature and properties of the fluid which is supposed to be concerned in these changes. In particular we might give an account of the later experiments and researches of philosophers, in investigating the formation of muriatic acid, and an alkali which is supposed to be soda, by means of this power. This forms one of the most curious subjects of inquiry which has yet occurred with regard to galvanism; but as some part of the investigations of those who have occupied their attention with this inquiry, is connected with theoretical views, we shall reserve the consideration of the whole to the second part of this treatise, the object of which is, to give a historical detail of the progress of galvanism, with the opinions of philosophers concerning the nature of the galvanic fluid. To this therefore we now proceed.

PART II. OF THE HISTORY AND PROGRESS OF GALVANISM.

IN the first part of this treatise we have given a pretty full view of the method of constructing apparatus for the purpose of exhibiting the phenomena of galvanism, and we have entered at considerable length into a detail of the experiments which have been made, to ascertain the effects of the galvanic fluid on animals, as well as those experiments by which its chemical effects are illustrated, with some of the theoretical views and opinions of those who have been engaged in researches concerning the properties of this fluid. It is now proposed, in the second part, first, to consider the progressive history of galvanism, with the theories by which philosophers have attempted to account for its effects; secondly, we shall endeavour to trace the analogy between artificial electricity and galvanism; and, lastly, give an account of the experiments and inquiries which have been made concerning the formation of muriatic acid and soda by means of this power. These will form the subjects of the three following chapters.

Chap. I. *History of the Discovery and Progress of Galvanism.*

48 First hint of galvanism.

THE first hint which is usually quoted as connected with the phenomena of galvanism, is extracted from a book entitled the General Theory of Pleasures, by Sultzer, which was published in the year 1767. In this work the author particularly describes the experiment with two dissimilar pieces of metal which we have related at the beginning of this treatise, and by which, we have endeavoured to illustrate what is understood by galvanism, in its effects on the living body. The experiment alluded to is that in which a piece of zinc and a piece of silver being placed, the one in contact with the upper, and the other with the under surface of the tongue, and their projecting edges being brought into contact, a taste is produced, which, the author observes, resembles vitriol of iron. This sensation is ascribed to a vibration of the particles of the metals affecting the nerves of the tongue.

Other hints and experiments have been quoted, which seem to be connected with the phenomena of galvanism; but as they were not prosecuted, and as no conclusion, with the view of establishing any particular point, was deduced from them, it would be unnecessary to give an account of them, excepting those of Vassalli, member of the royal academy of Turin, who published, in 1789, a theory on this subject, supported by a series of experiments which he had instituted. Here he throws out a conjecture, that a provision has been made by nature in the system of a living animal, by which the electricity accumulated in any particular part of the body is preserved and retained for some necessary purpose of its existence. It had indeed been supposed by some, that the animation of the blood depended on the electric fluid; but according to others, this fluid and the nervous fluid were to be considered as one and the same.

49 Galvani's discovery.

This subject was particularly investigated and illustrated, when in the year 1791 a remarkable discovery which was made by Dr Galvani, professor of anatomy in the university of Bologna in Italy, was announced to the world. This discovery, like most others, was accidental. Some frogs deprived of the skin were placed upon a table near which the professor happened to be engaged in experiments with an electrifying machine. The crural nerve of one of the frogs was touched by a person present, with the point of a scalpel during the time that the machine was working. The whole animal was thrown into convulsions. The same experiments were afterwards repeated with the same success. Every time that the scalpel was applied to the nerve, while the machine was in motion, violent convulsions were produced. But when the machine ceased to move, on the application of the scalpel to the nerve no effect followed. To this accidental discovery this branch of science owed its origin, and from the name of the discoverer was called *Galvanism*.

Since the period of this discovery, a great many experiments have been made, and many curious phenomena have been observed, which have excited much interest and attention among philosophers. We shall now present our readers with a historical sketch of the progress of these discoveries.

The experiment which has been mentioned was repeated by Galvani in every possible way he could think of. He varied it both by means of artificial and atmospherical electricity, and the result of all these experiments he found to be uniform and consistent. When Galvani first began his researches, he supposed that the phenomena depended on common electricity, passing through the animals on which the experiments were made. He had observed that the same effects were produced, but in a smaller degree, in living frogs and in other animals, as in those which had been newly deprived of life. In the course of some experiments which he made on atmospherical electricity, he suspended some frogs, by means of metallic hooks fixed in the spine, from iron palisades; and he observed that the muscles of these animals were frequently and involuntarily contracted, as if they had received a shock of electricity. At first he ascribed these convulsions to the

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the changes in the state of the electricity in the atmosphere; but after a repetition of the experiments he found that he was mistaken. He discovered, however, at last, after many ingenious experiments, that he could at pleasure produce the convulsions, by touching two different parts of the animal, each with a piece of metal, and then bringing these pieces of metal into contact. The experiment may be made in the following manner. Let the crural nerve of a frog be laid bare about an inch in extent; let a piece of zinc be placed in contaet with the nerve, and let a piece of silver be placed on the muscles with which the nerve communicates. Then bring the zinc and silver into contact, and the whole limb will be instantly thrown into convulsions.

After Galvani had published his experiments, the convulsions thus excited were ascribed to the action of some unknown fluid, to which the name *Galvanism* was

50 His theory.

given, or *Animal Electricity*. According to Galvani, a fluid is secreted in the brain, the same with the nervous fluid; but being analogous to common electricity, might with more propriety be termed animal electricity. The conductors of this fluid are the nerves. It is carried off by them as it is secreted, and deposited on the interior surface of the muscular fibres, which being non-conductors of the fluid, do not permit it to pass through them. The state of the muscular fibres exaetly resembled that of a charged Leyden jar. Their inner surface is electrified positively, and the outer surface is electrified negatively. The communication between the exterior and interior surfaces of the muscular fibres is formed by the nerves. They convey the redundant electricity from the internal to the external surface, and, like the effect of the electrical stimulus, every discharge is attended with a muscular contraction.

51 Volta's.

On the other hand Volta, another philosopher who carried his researches far into this subject, and of whose experiments and views we have given a long detail, adopted a different opinion. He thought that the convulsions occasioned by the galvanic apparatus were entirely independent of the action of the nervous fluid, and were to be ascribed to common electricity excited by the metallic conductors which are employed. These different opinions were supported with much ingenuity in a controversy which commenced between Galvani and Volta. The writers on galvanism divided themselves into two parties. While one party maintained with Volta, that the phenomena were owing to the action of common electricity on the muscular fibres, another party thought that they were entirely dependent upon something peculiar to animal matter. By many this seemed to have been considered as the nervous fluid, which was supposed to be the same with, or analogous to, common electricity.

It had been long asserted, that porter, and some other liquors, drank out of a pewter pot, had a different taste from what it has when drank out of glass or earthen ware. Pure mercury, it has been observed, retains its metallic splendour for a long time; but when amalgamated with any other metal, it is soon tarnished or oxidated. The Etruscan inscriptions on pure lead are in good preservation to this day; whereas some medals of lead and tin, of no great antiquity, are much corroded, and works of metal, whose parts are soldered together by the interposition of other metals, soon tarnish about the places where the different metals are joined. When the copper sheeting of ships is fastened on by means of iron nails, the nails, but particularly the copper, are readily corroded about the place of contact. A piece of zinc placed in water for a considerable time scarcely undergoes any change; but if a piece of silver happen to touch the zinc whilst it is in the water, it is soon corroded or oxidated.

In the course of a very few years after the publication of Galvani's discovery, a great number of writers appeared, and presented to the world a great body of facts which they had ascertained by experiments and observations. The following are among the most important: 1. When a piece of metal is placed on the muscle of an animal just dead, and still moist, and another piece of a different metal is placed on the nerve which leads to the muscle, or on another part of the muscle, and if the two pieces of metal be brought into contact, a contraction or convulsion of the muscle takes place. 2. A single piece of metal, or two pieces of the same metal, have no effect in exciting contraction of the muscle. It is necessary to have two perfect conductors of electricity in contact, before any convulsion can be produced. 3. The muscle must be moist. The effect is not prevented by a ligature on a nerve; but the susceptibility of a muscle to be thrown into convulsions is diminished, and at last destroyed, by the application of opium, which destroys irritability. The same change takes place if the muscle be allowed to remain for some time after death. 4. The different muscles of the body are differently affected by the galvanic influence. They are not equally susceptible of the same degree of convulsive effect. 5. If a plate of zinc be placed on the upper surface of the tongue, and a plate of silver or copper be applied to its under surface; and if the two pieces of metal thus placed be brought into contact, a strong metallic taste is immediately perceived. An acid taste is perceived, when the tongue is dipt into an alkaline solution contained in a tin or zinc cup held in the moist hand. 6. If a piece of metal, as a silver spoon, be placed on the ball of the eye, and another piece of a different metal, as a piece of zinc, be placed on the tongue, and if the two pieces of metal be brought into contact, a flash of fire is instantly perceived; and it is perceived, both when the metals are brought into contact, and when they are separated. 7. Another fact, which was ascertained by Aldini, who performed a great many experiments in galvanism during his visit to this country, is, that convulsions may be excited merely by forming a proper chain of muscles and nerves. This is proved by the following experiment. He took a prepared frog, and held it suspended in one hand by the foot. The sciatic nerves were brought into contact with the tongue of an ox, the head of which had been recently separated from the body. He then introduced the other hand moistened with a solution of common salt in water into the ear of the animal, thus completing the circle. Every time that the communication was formed, the muscles of the frog were thrown into convulsions.

Most of the facts which we have now related, were ascertained by the different philosophers, whose researches were directed to the subject of galvanism, between the years 1791 and 1794. Hitherto the connection between galvanism and animal bodies was considered by most

most writers, so close and intimate, that they supposed the one could not exist independent of the other. Some facts, however, which were established by Fabroni and others, seemed to favour the opinion of those who considered galvanism as the action of a peculiar fluid on the animal fibre. This fluid is developed by the mutual action of the metals employed as exciting causes, and it exists in other bodies as well as in those which are endowed with life. We have already mentioned that two pieces of different metals put into water produce changes on the water which neither of them separately could effect. This was observed by Fabroni, from which he concluded that a chemical change was effected by the metals on each other. To this change he supposed part at least of the phenomena of galvanism was owing.

53 Phenomena of galvanism ascribed to chemical action.

Thus he explained the necessity of two different metals and of moisture in the production of these phenomena. Those metals, he also observed, which occasioned the most rapid changes on each other in water, were most powerful in exciting galvanic convulsions.

Metals and charcoal, it was ascertained by Volta, being good conductors of electricity, attract and repel that fluid with different forces. When two different metals in their natural state of electricity are brought into contact, electric matter passes from the one to the other; the one becomes electrified positively, and the other negatively. From this he concluded, that the electricity which occasioned the galvanic phenomena did not reside in the animal fibres, but in the metals employed as exciters, and that the convulsions were produced by the electric matter passing through these fibres.

The seeming inconsistency which appeared in the opinions of Volta and Fabroni was removed by succeeding discoveries, which demonstrated that both electricity and chemistry were concerned in the galvanic phenomena. Galvanism was now no longer considered as something connected with living matter, which was totally inexplicable, but as something developed by the mutual action of inorganized substances on each other, the effect or energy of which might be estimated and measured by its action on the muscular fibres. The discovery of the galvanic pile by Volta put it in the power of philosophers to increase the power or energy of the galvanic influence at pleasure. This pile, and the method of constructing it, have been already described.

A description has also been given of a different apparatus, the invention of Mr Cruickshank of Woolwich, which has been employed in place of Volta's pile. This is called the *galvanic trough*, and it consists of a number of square plates of different metals as in the other, which are soldered together in pairs, and fixed by means of cement in a box of baked wood, at a small distance from each other.

Analogous to that of electricity.

A striking analogy was at once observed between this apparatus and charged electrics. A great deal of discussion took place on the subject; much investigation followed: and philosophers held different opinions concerning the phenomena of galvanism, whether it was to be considered as the same with common electricity, or as something specifically different.

It was at last ascertained by Nicholson and Carlisle, that the zinc end of the pile was in the state of positive electricity, and the silver or copper end in the negative state. The zinc end of the pile, then, according to the commonly received theory of electricity, gives out the electric fluid, which enters at the silver or copper end. And if the circle be completed by means of metallic wires or charcoal, when the pile is sufficiently powerful, sparks similar to what take place by the discharge of common electricity may be perceived. Electric batteries have been charged by means of the pile; metallic wires, tin-foil, gold leaf, are burnt; and mixtures of hydrogen and oxygen gas are exploded in the same way as happens when electric discharges are made to pass through them. From the whole of the phenomena, there seems now to be little doubt of the identity of the two fluids.

Chemistry, however, has a very considerable share in the phenomena of galvanism. The action of the pile is most powerful in oxygen gas: it ceases entirely in the vacuum of an air-pump, or in azotic gas. The electrical machine also, it has been ascertained, cannot be excited in any gas unless it contain oxygen; and it seems probable, that the effect of the amalgam, which is employed in exciting the electrical machine, bears a proportion to the facility or rapidity of its oxidation. But we shall discuss this point more fully in the second chapter.

When the action of the pile has continued for some time, it gradually becomes weaker, till at last its energy is entirely lost. This power can only be renewed by cleaning the plates, the surfaces of which have been very much changed. It was observed that the time in which the action of the pile ceased, was in proportion to the energy which it originally possessed. When it was strongest, the duration of its action was shortest. It was observed also, that one of each pair of plates was covered with a coat of oxide; and when this process of oxidation was finished, and the surface of the plate was entirely covered, the action ceased. Of the two metals employed in the construction of the pile, that which is most easily oxidated, always undergoes this process. When zinc and silver, or zinc and copper, are used, the zinc is always oxidated; and unless this oxidation take place, there is no action of the pile. Its action or energy is proportional to the oxidation of the metal; and thus it appears that this oxidation is essentially necessary to the action of the pile. For, unless the liquid which is employed to moisten the pieces of card or cloth between the pairs of plates, or that which fills the cells in the trough, be capable of oxidating the zinc, no action follows. There is no action at all with silver and zinc, and perfectly pure water. *In vacuo* the action of the pile soon ceases, even with common water; for the oxygen which is held in solution by the water soon combines with the zinc, and then the process stops. The action is increased by oxygen gas, because the oxidation of the zinc is facilitated. Its action is also increased, and goes on even *in vacuo*, when nitric acid, which supplies oxygen for the process of oxidation, is substituted for the water. Thus, by estimating the proportion between the oxidation of the metals and the action of the pile, it may be determined what metals are proper for forming piles, and with what liquids they may be employed. In the choice of the different metals, it must be observed, that one of them must always be more easily oxidated than the other. Two perfect conductors which are unequally oxidable, with an imperfect

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perfect conductor which is capable of oxidating the most oxidable of the perfect conductors, constitute the elements of the galvanic battery.

But some of the most important phenomena of galvanism are exhibited in its chemical effects. Most of these were first observed by the chemical philosophers of this country. We have already detailed many of the experiments by which these effects are illustrated; and we shall here only, for the sake of giving a connected view of this subject, merely recapitulate some of them.

55 Recapitulation of the chemical effects.

When water forms part of the circle between the extremities of the battery, and the conducting wires are brought within a small distance of each other, being immersed in a glass of water, the water is decomposed, and it will be recollected that the phenomena are different according to the nature of the wires employed. When the wires are of gold or platina, they undergo no change; oxygen gas is evolved in small bubbles from the positive wire, and hydrogen gas from the negative wire; and if the gases be collected separately by the apparatus formerly described, they are found to be in the proportions of the component parts of water. If one of the wires be immersed into one glass, and another into a separate glass, by completing the circle with a finger plunged into each glass, the process goes on, and the hydrogen gas is extricated in the one vessel, while the oxygen is given out from the wire in the other. This fact was first discovered by Mr Davy. When spring water is used, or water having azotic gas in solution, an acid is formed at the extremity of the positive wire, and an alkali at the extremity of the negative wire. The acid was found to be nitric, and the alkali ammonia. If the wires be plunged in different glasses, and the connection be formed by means of an animal body, the positive wire produces in the water tinged with an infusion of litmus, a red colour, while the negative wire also reddens an infusion of brasil wood.

If other wires besides those of gold or platina be used, it is found that the positive wire undergoes oxidation, but little or no gas is separated from it; while the negative wire, as in the former case, gives out hydrogen gas. When the wires are immersed into metallic solutions, as acetate of lead, nitrate of silver, &c. the silver or lead is revived, and deposited on the negative wire; and if solutions which contain sulphuric, nitric, or oxymuriatic acids, are used for the immersion of the conducting wires, the acids are decomposed, oxygen gas is evolved from the positive wire, and sulphur or hydrogen gas makes its appearance at the negative wire. The decomposition of ammonia has already been mentioned. This was discovered by Mr Henry. The hydrogen is given out by the negative wire, while the azotic gas is evolved by the positive wire. When plumbago or charcoal are employed as conductors in place of metals, it is found that carbonic acid is evolved from the positive end, and hydrogen gas from the negative.

It may be necessary here to describe a galvanic battery, constructed by Mr Davy, on principles somewhat different from that of Volta. In the Voltaic pile there are two perfect conductors, and one imperfect conductor; but this consists of two imperfect, and one perfect conductor: the two imperfect conductors are nitrous acid and liquid sulphuret of potash. A trough is divided into cells with slips of horn and plates of zinc, arranged alternately; nitrous acid is poured into the first cell, and sulphuret of potash into the second; the two liquids being separated by the slip of horn, a communication is formed between them by means of a moist piece of cloth laid over the horn, and in the same way the rest of the cells are filled. In this case the liquids are the imperfect conductors, and the zinc is the perfect one; and the action of the battery continues till the oxidation of one of the surfaces of the zinc takes place, the other surfaces remaining unchanged.

Having finished the short view which we proposed to give of the history and progress of galvanism, we should next proceed to detail some of the later experiments and discoveries which have been made on this subject. What we here chiefly allude to, is the discovery of the formation of muriatic acid and soda by means of the galvanic fluid. But this is proposed to be the subject of a separate chapter. We shall therefore proceed in the next chapter to consider the hypothesis by means of which the phenomena of galvanism have been explained, and to point out the analogy between electricity and galvanism.

Chap. II. *Of the Theory of Galvanism, and the Analogy between the Galvanic Fluid and Electricity.*

We have already observed that the philosophers who were occupied in researches on galvanism, early divided themselves into two parties. According to one party, with Volta at their head, the phenomena of galvanism were ascribed to the action of common electricity on the muscular fibres; while another party maintained the opinion that they depended entirely on something peculiar to animal matter. This was the opinion of Galvani himself, the original discoverer, and it was supported by his nephew Aldini, with certain modifications. The greater number of philosophers have now adopted the opinion of Volta, as being more consistent with the phenomena. We shall therefore now give a more particular account of the hypothesis which has been more generally followed in explaining these phenomena on the principles of electricity.

According to the received principles of electricity, there is a subtile fluid which exists in all bodies; but the existence of this fluid can only be recognised when the proportion which a body contains is greater or less than the quantity which is natural to it. When the quantity is greater than usual, the body is said to be electrified *positively* or *plus*; and when the quantity is less than usual, the body is said to be electrified *negatively* or *minus*. The electric fluid penetrates certain bodies, and passes through them with facility, and these bodies are called *conductors of electricity*; but there are other bodies which it cannot pass through without difficulty, these bodies are called *non-conductors* or *electrics*. Of conductors there are two kinds; one of which is denominated *perfect*, because the electric fluid passes through them with ease; the other is called *imperfect* conductors, because the fluid passes through them with difficulty. The perfect conductors are solid bodies which are susceptible of oxidation; and when they enter into combination with oxygen, they lose their properties as perfect conductors. The metal and charcoal are

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Affinity of the electric fluid for conductors; There is an affinity between the perfect conductors and the electric fluid, in consequence of which this fluid remains in combination with the perfect conductor, till it is attracted by some body, for which it has a stronger affinity, or is excelled by some body combining with the conductor, for which the conductor has a stronger affinity than it has for the electric fluid. Perfect conductors possess different forces or degrees of affinity for the electric fluid. Thus, if two perfect conductors be brought into contact, the proportion of electric matter in each of them changes. That conductor which has the strongest affinity for the fluid, is electrified positively, or plus; and the conductor which has the weaker affinity is electrified negatively or minus. If a plate of zinc and one of copper, each of which possesses its natural proportion of electric fluid, be brought into contact, the zinc is electrified plus, and the copper minus; or, if iron and silver be brought into contact, the iron is electrified plus, and the silver minus; and if no other circumstances operate to change the state of the electricity, these two states will be permanent.

But, when a perfect conductor in the positive state of electricity, enters into combination with oxygen, it parts with the excess of electric fluid which it contained, and the discharge is made towards the side of the conductor which is combined with oxygen. The affinity of imperfect conductors for the electric fluid is weaker than that of the perfect conductors, so that, if a perfect and imperfect conductor be brought into contact, the perfect conductor becomes plus, and the imperfect minus; and this state is not changed, if the imperfect conductor cannot communicate oxygen to the perfect one.

for hydrogen. Between the electric fluid and hydrogen there is also an affinity, so that the electric fluid combines with hydrogen, provided this latter be present when the fluid is separated from a perfect conductor. The electric fluid is differently conducted through the bodies which are called perfect and imperfect conductors. The fluid passes through the perfect conductors, in its simple and uncombined state; but unless the fluid be combined with hydrogen, it cannot pass through the imperfect conductors, and this compound of electricity and hydrogen is capable of passing invisibly through liquid conductors.

Let us now suppose a plate of copper and another of zinc to be brought into contact, the zinc is immediately electrified plus, and the copper minus; but let us suppose also, that the surface of the zinc farthest from the copper, is brought into contact with a liquid which can communicate oxygen to that surface, so that it becomes oxidated, such, for instance, is water impregnated with common air, or with an acid. As soon, then, as the oxygen of the imperfect conductor combines with the zinc, the excess of its electricity is separated, and passes towards the imperfect conductor; but the zinc is oxidated by the decomposition of the water, the oxygen of which combines with the metal, while the hydrogen is set free. The electricity of the perfect conductor enters into combination with the hydrogen, and in this state it can pass through the imperfect conductor. If then the imperfect conductor be in contact on the other side with a perfect conductor, such as a plate of copper, which cannot, in this case, be oxidated, the electric fluid leaves the imperfect conductor, and enters the perfect one; but it cannot combine with a perfect conductor while it is in union with hydrogen; the hydrogen, therefore, is left behind, and, accordingly, when the electric fluid passes from the perfect to the imperfect conductor, a portion of hydrogen gas is given out at the surface of the perfect conductor; or, if that surface has undergone any degree of oxidation, the hydrogen combines with the oxygen, and thus leaves the conductor in the metallic state. But, farther, if a plate of zinc be in contact with a plate of copper, the fluid having a greater affinity for the zinc, will enter it; and if the zinc be again followed by another imperfect conductor, its surface is oxidated, the electricity is disengaged; it combines with hydrogen, and passes through the imperfect conductor as in the former case. Whatever the number of these sets of bodies may be, if they are arranged in the same order, the same phenomena will be exhibited.

Let us now suppose, that a battery is constructed, either in the form of a pile or trough, of any given number of pairs or plates; and suppose, if this battery is in the form of a pile, that the uppermost plate is zinc, the lowest is therefore of copper; the zinc is electrified plus, and the copper minus. If, then, a communication is established between the upper and lower plates of the pile, by means of conductors, according to the laws of electricity, the excess at the top of the pile immediately passes to the bottom. A current of electricity, therefore, will pass through the pile, and will continue till the surfaces of the zinc next the imperfect conductors are completely oxidated, when the action ceases, because the double decompositions on which this action depends, can no longer take place.

The number of repeated charges which pass through the pile, must be in proportion to the number of plates, so that the intensity of the pile increases with the number of plates of which it is composed. Hence it is, that the effects of galvanism on animals is found to be in proportion to the number of plates employed in the battery; but this depends upon its intensity, or the number of discharges followed by intervals, which pass through the body in a given time. 59 Different effects from the number of plates,

But, on the other hand, the effect of the galvanic fluid on metallic substances depends on the absolute quantity which passes through the metal in a given time. But the absolute quantity of fluid discharged from a single pair of plates, must be proportional to the surface of these plates; and hence it is, that the quantity of electricity discharged from a pile in a given time, depends upon the surface of the plates. When a battery is discharged, the small charge contained in each pair of plates, passes through the discharger; but there must be an interval between each of those separate charges, for they cannot be supposed to pass instantaneously, although the interval being too small to be perceptible, the discharge of the battery seems to be instantaneous. As then the number of small discharges which are apparently instantaneous, when a battery is discharged, is in proportion to the number of plates, the 60 and extent of surface.

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the intensity of each little discharge is proportional to the places which the pair of plates occupies in the battery; and hence it is, that the shock is increased by the number of plates more rapidly than the effect of the battery on metals is increased; but, on the contrary, the surface of the plates being increased, the effect on metals is also increased, because the quantity discharged at once from the upper pair is increased; and it seems to be in this way that the effect on metallic substances is produced.

61 Chemical effects.

In the same way the chemical changes which are effected by means of galvanism may be explained. Let it be supposed, that a gold wire, connected with the upper plate of the battery, terminates in a glass of water, and another gold wire, from the lower plate of the battery, terminates in the same water. The circle is then completed by the gold wire, which is a perfect conductor. The current of electricity passes through the wire which is connected with the uppermost plate to the base of the battery, and it would pass uninterruptedly, if there were no interval between the wires. This interval is supplied with water, and, when the electric fluid reaches the extremity of the wire, it must pass through the water, but it can only pass through an imperfect conductor when it is in combination with hydrogen. It therefore combines with the hydrogen of the water, which is accordingly decomposed at the point of the wire. The oxygen is disengaged, and the hydrogen in combination with the electricity passes through the water till it reach the point of the other wire; and the affinity between this wire and the electric fluid being greater than the affinity of the latter for water, the electric fluid enters the wire, and passes on to the other end of the battery; but the hydrogen is previously separated from the extremity of this second wire, in the form of gas, because the fluid cannot enter the wire in combination with hydrogen.

If the wires are immersed in ammonia, the hydrogen is derived from that substance of which it forms one of the component parts; the azotic gas, the base of which is its other constituent, is evolved at the extremity of the first wire, and hydrogen gas at the extremity of the second. But, if the wires are plunged in the water which contains common air, and consequently a certain portion of azote, as oxygen gas combines with azote in its nascent state, or at the moment of its evolution, the compound resulting from this combination is nitric acid. Hydrogen gas also, in its nascent state, will combine with azote, and ammonia is the result of this combination. Hence it is, that in some experiments nitric acid is found at the point of the positive wire, and ammonia at the point of the negative wire, when common water is employed.

When liquids holding in solution a metallic salt, the base of which is an oxide of the metal, are employed; as hydrogen gas possesses the property of reducing or reviving metals, if in its nascent state it comes in contact with their oxides, the metallic salts are in this case decomposed, and the metal is revived. It is found deposited on the negative wire. When copper or iron wires are employed to complete the circle, instead of wires of gold or platina, as oxygen has the property of combining with these metals, at the moment of its disengagement, it is deposited on the positive wire, and in this case none is separated from it; but if the circle be completed by means of charcoal or plumbago, and the interval between these conducting substances be water, carbonic acid gas is separated from the positive conductor, because the oxygen in its nascent state is susceptible of combination with carbone; and the hydrogen in the same state combining with carbone, carburetted hydrogen is given out by the negative conductor.

Such is the hypothetical explanation which has been given of the action of galvanism, and the phenomena which it exhibits. A fuller view of the analogy between galvanism and electricity has been given by Dr Wollaston.

"Notwithstanding, he observes, the power of Mr Volta's electric pile is now known to be proportional to the disposition of one of the metals to be oxidated by the fluid interposed, a doubt has been entertained by many persons, whether this power arises from the chemical action of the fluid on the metal, or, on the contrary, whether the oxidation itself may not be occasioned by electricity, set in motion by the contact of metals that have different conducting powers.

Elec[...] evol[...] durin[...] dati[...]

"That the oxidation of the metal is the primary cause of the electric phenomena observed, is, I think, to be inferred from the following experiments, which exhibit the galvanic process reduced to its most simple state.

"*Exper.* 1.—If a piece of zinc and a piece of silver have each one extremity immersed in the same vessel, containing sulphuric or muriatic acid diluted with a large quantity of water, the zinc is dissolved, and yields hydrogen gas, by decomposition of the water; the silver, not being acted upon, has no power of decomposing water; but, whenever the zinc and silver are made to touch, or any metallic communication is made between them, hydrogen gas is also formed at the surface of the silver.

"Any other metal besides zinc, which by assistance of the acid employed is capable of decomposing water, will succeed equally, if the other wire consists of a metal on which the acid has no effect.

"*Exper.* 2.—If zinc, iron, or copper, is employed with gold in diluted nitric acid, nitrous gas is formed; in the same manner, and under the same circumstances, as the hydrogen gas in the former experiment.

"*Exper.* 3.—Experiments analogous to the former, and equally simple, may also be made with many metallic solutions. If, for instance, the solution contains copper, it will be precipitated by a piece of iron, and appear on its surface. Upon silver merely immersed in the same solution, no such effect is produced; but as soon as the two metals are brought into contact, the silver receives a coating of copper.

"In the explanation of these experiments, it is necessary to advert to a point established by means of the electric pile.

"We know that when water is placed in a circuit of conductors of electricity, between the two extremities of a pile, if the power is sufficient to oxidate one of the wires of communication, the wire connected with the opposite extremity affords the hydrogen gas.

"Since the extrication of hydrogen, in this instance, is seen to depend on electricity, it is probable, that in other instances, electricity may be also requisite for its conversion into gas. It would appear, therefore, that in the solution of a metal, electricity is evolved during the

the action of the acid upon it; and that the formation of hydrogen gas, even in that case, depends on a transition of electricity between the fluid and the metal.

"We see, moreover, in the first experiment, that the zinc, without contact of any other metal, has the power of decomposing water; and we can have no reason to suppose that the contact of the silver produces any new power, but that it serves merely as a conductor of electricity, and thereby occasions the formation of hydrogen gas.

"In the third experiment also, the iron by itself has the power of precipitating copper, by means, I presume, of electricity evolved during its solution; and here likewise the silver, by conducting that electricity, acquires the power of precipitating the copper in its metallic state.

"The explanation here given receives additional confirmation from comparative experiments, which I have made with common electricity; for it will be seen that the same transfer of chemical power, and the same apparent reversion of the usual order of chemical affinities in the precipitation of copper by silver, may be effected by a common electrical machine.

"The machine with which the following experiments were conducted, consists of a cylinder seven inches in diameter, with a conductor on each side, 16 inches long, and three and a half inches diameter, each furnished with a sliding electrometer, to regulate the strength of the spark received from them.

"*Exper* 4.—Having a wire of fine silver $\frac{1}{120}$ of an inch in diameter, I coated the middle of it for two or three inches, with sealing wax, and by cutting through in the middle of the wax, exposed a section of the wire. The two coated extremities of the wire, thus divided, were immersed in a solution of sulphate of copper, placed in an electric circle between the two conductors; and sparks, taken at $\frac{1}{10}$ of an inch distance, were passed by means of them through the solution. After 100 turns of the machine, the wire which communicated with (what is called) the negative conductor, had a precipitate formed on its surface, which, upon being burnished, was evidently copper; but the opposite wire had no such coating.

"Upon reversing the direction of the current of electricity, the order of the phenomena was of course reversed; the copper being shortly re-dissolved by assistance of the oxidating power of positive electricity, and a similar precipitate formed on the opposite wire.

"*Exper.* 5.—A similar experiment made with gold wires $\frac{1}{100}$ of an inch diameter, in a solution of corrosive sublimate, had the same success.

"The chemical agency, therefore, of common electricity, is thus proved to be the same with the power excited by chemical means; but, since a difference has been observed in the comparative facility with which the pile of Volta decomposes water, and produces other effects of oxidation and de-oxidation of bodies exposed to its action, I have been at some pains to remove this difficulty, and can at least produce a very close imitation of the galvanic phenomena, by common electricity.

"It has been thought necessary to employ powerful machines, and large Leyden jars, for the decomposition of water; but when I considered that the decomposition must depend on duly proportioning the strength of the charge of electricity to the quantity of water, and that the quantity exposed to its action at the surface of communication depends on the extent of that surface, I hoped that, by reducing the surface of communication, the decomposition of water might be effected by smaller machines, and with less powerful excitation, than have hitherto been used for that purpose; and, in this hope, I have not been disappointed.

"*Exper.* 6.—Having procured a small wire of fine gold, and given it as fine a point as I could, I inserted it into a capillary glass tube; and after heating the tube, so as to make it adhere to the point and cover it in every part, I gradually ground it down, till, with a pocket lens, I could discern that the point of the gold was exposed.

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in decomposing water,

"The success of this method exceeding my expectations, I coated several wires in the same manner, and found, that when sparks from the conductors before-mentioned were made to pass through water, by means of a point so guarded, a spark passing to the distance of one-eighth of an inch would decompose water, when the point exposed did not exceed $\frac{1}{700}$ of an inch in diameter. With another point, which I estimated at $\frac{1}{1500}$, a succession of sparks $\frac{1}{20}$ of an inch in length, afforded a current of small bubbles of air.

"I have since found, that the same apparatus will decompose water, with a wire $\frac{1}{40}$ of an inch diameter, coated in the manner before described, if the spark from the prime conductor passes to the distance of $\frac{4}{10}$ of an inch of air.

"*Exper.* 7.—In order to try how far the strength of the electric spark might be reduced by proportional diminution of the extremity of the wire, I passed a solution of gold in *aqua regia* through a capillary tube, and, by heating the tube, expelled the acid. There remained a thin film of gold, lining the inner surface of the tube, which, by melting the tube, was converted into a very fine thread of gold, through the substance of the glass.

"When the extremity of this thread was made the medium of communication through water, I found that the mere current of electricity would occasion a stream of very small bubbles to rise from the extremity of the gold, although the wire, by which it communicated with the positive or negative conductor, was placed in absolute contact with them. Hence it appears, that decomposition of water may take place by common electricity, as well as by the electric pile, although no discernible sparks are produced.

"The appearance of two currents of air may also be imitated, by occasioning the electricity to pass by fine points of communication on both sides of the water: but, in fact, the resemblance is not complete; for, in every way in which I have tried it, I observed that each wire gave both oxygen and hydrogen gas, instead of their being formed separately, as by the electric pile.

"I am inclined to attribute the difference in this respect to the greater intensity with which it is necessary to employ common electricity; for, that positive and negative electricity, so excited, have each the same chemical power as they are observed to have in the electric pile, may be ascertained by other means.

"In the precipitation of copper by silver, an instance of de-oxidation (or phlogistication) by negative electricity has been mentioned; the oxidating power of positive

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sitive electricity may be also proved, by its effects on vegetable blue colours.

65 and in changing the blue colour of vegetables.

"*Exper.* 8.—Having coloured a card with a strong infusion of litmus, I passed a current of electric sparks along it, by means of two fine gold points, touching it at the distance of an inch from each other. The effect, as in other cases, depending on the smallness of the quantity of water, was most discernible when the card was nearly dry. In this state a very few turns of the machine were sufficient to occasion a redness at the positive wire, very manifest to the naked eye. The negative wire, being afterwards placed on the same spot, soon restored it to its original blue colour.

"By Mr Volta's apparatus the same effects are produced in much less time.

"Besides the similarity which has thus been traced between the effects of electricity excited by the common machine, and those observed from the electric pile, I think it appears also probable, that they originate from the same source.

"With regard to the latter, its power is known to depend on oxidation; so also does the excitement in the former appear very much to depend on the same process; for,

"*Exper.* 9.—I have found that, by using an amalgam of silver or of platina, which are not liable to be oxidated, I could obtain no electricity. An amalgam of tin, on the contrary, affords a good degree of excitement. Zinc acts still better; but the best amalgam is made with both tin and zinc, a mixture which is more easily oxidated than either metal separately.

"*Exper.* 10.—But, as a farther trial whether oxidation assists in the production of electricity, I mounted a small cylinder, with its cushion and conductor, in a vessel so contrived, that I could at pleasure charge the contained air.

"After trying the degree of excitement in common air, I substituted carbonic acid gas, and found that the excitement was immediately destroyed, but that it returned upon re-admission of atmospheric air.

"In conformity to this hypothesis, we find that the metal oxidated is, in each case, in a similar state of electricity; for the cushion of the machine, by oxidation of the amalgam adhering to it, becomes negative; and in the same manner, zinc, oxidated by the accumulated power of an electric pile, or simply by action of an acid, is also negative.

"This similarity in the means by which both electricity and galvanism appear to be excited, in addition to the resemblance that has been traced between their effects, shews that they are both essentially the same, and confirms an opinion that has already been advanced by others, that all the differences discoverable in the effects of the latter, may be owing to its being less intense, but produced in much larger quantity*."

This analogy was still farther established by the experiments of Van Marum, in which he succeeded in charging an electrical battery, consisting of $137\frac{1}{2}$ square feet, by means of the galvanic pile. On examining the power of the shocks which were given by the battery charged with the pile, it was found that the shock from 100 pairs of plates was about equal to a shock from the battery, when it was charged by means of 200. A pile of 200 pairs of plates seemed to have six times the power of an electrical machine having a plate of 31 inches diameter.

* Phil. Trans. 1801. p. 427.

66 Distinguishing property between galvanism and electricity.

The following experiments made by Mr Cuthbertson, with galvanic batteries, are supposed by him to afford a distinguishing property between the galvanic and electric fluids. 1. Charcoal was deflagrated and ignited for above an inch in length. 2. Iron wire $\frac{1}{40}$ of an inch diameter was melted into a ball of $\frac{1}{16}$ inch diameter. 3. Platina wire $\frac{1}{100}$ inch diameter, was melted into a ball $\frac{1}{10}$ inch diameter. 4. Brass wire $\frac{1}{20}$ inch diameter, three-fourths of an inch in length was ignited. 5. Brass wire $\frac{1}{16}$ inch diameter was red hot at the end. 6. Iron wire $\frac{1}{150}$ inch diameter was red hot for 16 inches in length. 7. Iron wire 12 inches deflagrated, and melted into a ball. 8. Iron wire six inches in length was deflagrated. 9. Iron wire eight inches in length was ignited.

The first seven experiments above were made with two troughs, each containing 30 pairs of plates, six inches square, but in the last two experiments, one of these troughs only was used. The conclusion drawn from the four last experiments is, that double quantities of galvanic fluid only burn double lengths of wire, and not the square, as electrical discharges do*.

To discover what quantity of coated glass would be required to take a charge sufficient to ignite the same lengths of wire, the two last experiments were compared with common electrical discharges. Two jars, each containing about 170 square inches of coating, were set to the conductor of a 24 inch single-plate electrical machine, with the author's universal electrometer, loaded with 31 grains. Eight inches of the same kind of wire were laid in the circuit, and with 57 revolutions of the plate the electrometer discharged the jars, and the wire was ignited as perfectly as in experiment 9th. Afterwards six inches of the wire being laid in the circuit, a discharge was produced with the same number of revolutions of the machine, and the wire was deflagrated, and fused into balls, in the same manner as in the 8th experiment. Hence he concluded, that 340 square inches of coated glass, properly constructed, are sufficient to bear a charge equal to a galvanic battery of 1080 square inches of surface. On comparing the above experiments with some others made some time before, the author finds it necessary to modify the conclusion which he had deduced from them. With a pile of 16 pairs of plates, of 10 inches diameter, eight of which were laid upon each other in the usual manner, and cloths moistened with diluted muriatic acid interposed, he burnt half an inch of wire of $\frac{1}{195}$ inch diameter; and when the other eight pairs were added, he burnt four inches of the same wire. This was repeated with the eight in pairs with the same result, with respect to the burning of metals, but it gave strong and loud sparks from metal to metal, which might be heard at the distance of 300 yards. This result, he observes, had not been attained from troughs, to be heard at any distance. In the last experiment the cloths were moistened with a strong solution of muriate of ammonia. Comparing this effect of the pile and the trough, Mr Cuthbertson thinks there is some defect in the arrangement or construction of the latter.

* Phil. Mag. i. 358.

In many experiments which Volta made on piles composed of a single metal, and a single wet stratum, which

which of themselves are inactive, it was found that they became more or less active, after affording a passage for a longer or shorter time to an electric current, which was set in motion by an active pile. According to Ritter, the active pile or common electrometer transmits a real charge to the pile, which is itself inactive, and this he calls the *charged pile*. Volta, however, is of opinion, that no charge is transmitted but by means of the ordinary chemical action; for the electrical current being continued, changes the single wet stratum interposed between two pieces of gold, for example, into two different fluids; one acid, by which the electric current issues out of the metal, and the other alkaline, by which it enters, thus constituting a pile of the second order, composed of one metal, and two fluids of different natures. The action of this pile, however, soon ceases, because the fluids soon mix together *.

* Nichol. Jour. xi. 74.

Formation of Muriatic Acid, &c.

Chap. III. *Of the Formation of Muriatic Acid and Soda, by means of Galvanism.*

Some of the most curious phenomena which have yet been exhibited in galvanism, relate to the formation of muriatic acid by means of this power. In the account which has been given of Mr Cruickshank's experiments, it will be recollected that he made the discovery of the formation of an acid and alkali, during the action of the galvanic battery. This acid, he concluded, was the nitric, and the alkali, ammonia. The theory of the production of these substances in the galvanic pile has been already mentioned, and it corresponds with the explanation of the principles which have been adopted for explaining the phenomena of galvanism; later researches, however, have been conducted with more accurate observation, or have opened a wider field of discovery. The truth of this remark will be fully confirmed, if it be at last finally ascertained, that common salt, the component parts of which are muriatic acid and soda, is produced by the action of galvanism.

Mr Peel's discovery of the formation of muriat of soda.

The first hint of this discovery was given by Mr Peel of Cambridge, in a letter dated April 1805, addressed to the editor of the Philosophical Magazine †, of which the following account is given in his own words. "I took (says he), about a pint of distilled water, and decomposed one half of it by means of galvanism; the other half I evaporated, and I found to remain at the bottom of the glass a small quantity of salt, which upon examination I found to be muriate of soda, or common salt.—What induced me to try the experiment was this; I knew that when water was decomposed by means of galvanism, the water near one of the wires had alkaline, while that near the other had acid properties. This being the case, I inferred, that if an alkali and an acid were really produced, I should, by decomposing a large quantity of water, obtain a small quantity of some kind of neutral salt: as was actually the case on trying the experiment. The salt could not have been contained in the water before I made the experiment, because I used every precaution to have it free from impurities. I even took the trouble to repeat the experiment, though a tedious one, and I again obtained the same result." He adds, that a similar experiment being repeated by a friend of his, afforded a similar result.

† Ib. xxi. p. ...

It having been suggested to Mr Peel, that it might be worth while to vary the experiment, by employing water formed of its elements, he gives the following account of the result of this process, in another letter, dated June 1805.

Formation of Muriatic Acid, &c.

"Having proceeded, he observes, to the formation of water from its elements, with which to repeat my former experiment, I found when the oxygen and hydrogen gases were quite pure, and exactly in due proportion, that no residuum of air was left, and that the water formed was not in the slightest degree acidulous. When the process was not conducted with great accuracy, or any precaution to have it accurate was omitted, I then found the water acidulous, and the acid that caused this acidity to be the nitric acid.

"The acidulous water thus obtained I neutralized with lime, from which I distilled the water, and this water I decomposed by the galvanic process, as in the experiment detailed in my former letter.

"I did not imagine the using water so obtained could make the least difference on the result of the experiment; but as a wish was expressed to have the trial made, I again undertook that interesting but very tedious labour.

"When I came to examine the residuum, to my great astonishment I found that not muriate of soda, but muriate of potash, was produced. I must own I feel myself entirely at a loss how to account for this, nor shall I attempt it; all I can say is, that this, as well as my former experiment, was conducted with the greatest care and accuracy that I could bestow *."

* Phil. Mag. xxii. 153.

168 Pacchiani's, of muriatic acid.

About the same time a discovery of a similar nature was made by Professor Pacchiani of Pisa. This discovery, which relates to the composition of muriatic acid, was first announced in this country in the number of the Edinburgh Medical and Surgical Journal, published the 1st July 1805. The following is an account of his experiments, and the conclusions which he deduces from them in his own words. "The simplicity of the apparatus, (he says), and of the means adopted to attain my views, the care with which I endeavoured to avoid every source of error, have, I hope, sufficiently secured me against those illusions which frequently deceive young men ardent in the pursuit of science, and even those practised in the art of extorting from nature her secrets. Want of time prevents me from relating the series of experiments by which I arrived at the discovery I have mentioned; but you may see it by perusing the manuscript of my memoir, which will be immediately published, to submit my researches and their results to the judgment of the learned. For the present, I shall select from the experiments and facts therein described those which are decisive, and which establish, in an evident manner, the following truths:—

"I. Muriatic acid is an oxyde of hydrogen, and consequently composed of hydrogen and oxygen.

"II. In the oxygenated muriatic acid, and therefore, *à fortiori*, in muriatic acid, there is a much less proportion of oxygen than in water.

"III. Hydrogen is susceptible of very many and different degrees of oxidation, contrary to what is universally believed by pneumatic chemists, who assert that hydrogen is susceptible only of one invariable degree of oxidation, that in which it forms water.

"Having at first examined the phenomenon of the decomposition of water by the galvanic pile, and having, by accurate experiments, ascertained the true theory, Formation of Muriatic Acid, &c.

theory, I readily discovered a very simple and exact apparatus, in which I could distinctly perceive the changes which happen to water, which, from the continued action of the galvanic pile, is continually losing its oxygen at the surface of a wire of very pure gold immersed in it.

"I therefore proceeded to examine these gradual changes of water thus losing its oxygen; and I at last observed a very singular fact, which unequivocally indicated the formation of an acid. In other antecedent experiments I had examined the nature of the air obtained before arriving at this remarkable point, and I always found, by means of the eudiometer of Giobert, that it was very pure oxygen, as the residuum scarcely amounted to one-sixtieth.

"Having thus examined the nature of the air formed in various experiments, from the first moment of decomposition, until there were evident indications of the formation of an acid, I began to endeavour to determine, in a more positive manner, the existence and nature of this acid.

"When the water, or, to speak more accurately, the residual fluid, occupied about half the capacity of the receiver, which at first contained the water, this residual fluid presented the following characters:

"Its colour was an orange yellow, more or less deep, according as the bulk of the residual liquor was greater or less, and it resembled in appearance a true solution of gold.

"From the inferior orifice of the vessel, which was closed with a piece of taffety, and then with double bladder, there escaped a smell which was easily recognized to be that of oxygenated muriatic acid.

"The gold wire had in part lost its metallic lustre, and its surface appeared as if corroded by a solvent.

"The bit of taffety which had been in contact with the coloured fluid, in consequence of its action, was easily torn, as is usual with similar bodies when half burnt (*semi-combusto*).

"Around the edges of the vessel, on the bladder, there was formed a deep purple ring, which surrounded a circular space rendered entirely colourless, or white.

"A drop of this fluid tinged the skin of the hand, after some hours, with a beautiful rose colour.

"Having obtained, in various successive experiments, the same liquid, possessing constantly the same properties, I chose that obtained in the last experiment to subject it to chemical examination. The very able chemist of this university, Signior Giuseppe Branchi, had the goodness to enter zealously into my views; and in his laboratory we easily proved,

"1. The existence of a volatile acid, by the white vapours which were formed by ammonia placed near it.

"2. That this acid was certainly oxygenated muriatic acid, since it formed in nitrate of silver a curdy precipitate, the luna cornea of the ancients, or the muriate of silver of the moderns. From these facts we may draw the following positive and undeniable results:

"1. Muriatic acid is an oxyde of hydrogen, and is therefore composed of hydrogen and oxygen.

"2. Oxygenated muriatic acid, and of course muriatic acid, contains less oxygen than water does.

"3. Hydrogen has not one degree of oxygenation, but many. One of these constitutes water, another below it oxygenated muriatic acid, and, below this, there is another which constitutes muriatic acid."

69 Henry's remarks.

Mr Henry of Manchester, in an account of his investigations on this subject, observes that there is a considerable point of difference between the English and the Italian chemist. The result of Mr Peel's experiment was found to be muriate of soda; but in Professor Pacchiani's, in which an interrupted gold wire was employed, it appeared to be muriate of gold. This ingenious chemist, with the same view, made the following experiment. He took a glass tube $4\frac{1}{2}$ inches long, 35 inches diameter, in which were secured with corks, two slips of platina, having their extremities at a proper distance to effect the decomposition of the water. The quantity of water, at the beginning of the experiment, amounted to two drams. After being exposed to the galvanic action for six days, it was so far diminished, that $\frac{1}{2}$ inch of the tube was unfilled. The water which was employed was carefully purified, by being first distilled, and then, after adding nitrate of silver, by a second distillation. After the experiment was finished, with the addition of nitrate of silver, it became opalescent in a few seconds, and being exposed to the light, exhibited those changes which indicate the presence of muriatic acid. It did not appear that muriate of platina had been produced, for muriate of ammonia being added to one portion, and carbonate of soda to another, produced no precipitation.

In making this experiment, Mr Henry suggests a very useful precaution. The water employed, he observes, should never, on any account, come into contact with the fingers, because there is a constant excretion of muriate of soda from the skin, and in this way the purest water is very soon contaminated. He recommends also, that glass stoppers should be employed in place of corks, for transmitting the conducting wires *.

* Ibid.

70 New experiments of Mr Peel.

In another communication by Mr Peel on the same subject, he relates the following experiments, which were undertaken, he says,

"1st, To determine whether the difference in the result of the before-mentioned experiments was owing in any degree to my having employed lime to neutralize the water employed in my second experiment, before it was distilled.

"2d, To ascertain whether the salts found in the residual water, or any component part of them, came from the galvanic battery by means of the wires.

"To determine the first point, I varied my experiment by employing for decomposition water distilled under different circumstances.

"*Exper.* 1.—The water employed in this experiment was distilled from water containing lime. A portion of it was decomposed in the manner that has before been stated. The remaining water yielded muriate of potash.

"*Exper.* 2.—Water distilled from water containing magnesia was decomposed in the same manner. The result was muriate of soda.

"*Exper.* 3.—In this experiment double distilled snow water was employed. The result was muriate of soda.

"*Exper.*

"*Exper.* 4.—Water distilled from barytes was now used. The result was still muriate of soda.

"The water which I used in the experiment detailed in my first letter was distilled from pump water (the pump is on the premises where I live), which I have not myself analyzed, but a friend has been so good as to take upon him that trouble. He has not been able to detect it in the minutest portion of magnesia. In one of the above experiments, having used water distilled from magnesia, I obtained muriate of soda; but, having obtained the same result from distilled snow water, and from water distilled from barytes, I conclude that the production of the soda has nothing to do with the presence of magnesia.

"But, in the production of potash, the presence of lime seems to be essential, and, as you hinted, a portion of lime must have been carried over with the distilled water, a fact which few would suspect, and which probably may often be the cause of differences in the results of chemical investigations, conducted, to all appearance, in a similar manner.

"To determine the second point which I had in view, namely, whether the salts found in the residual water, or any component part of them, came from the galvanic battery by means of the conducting wires, I made similar experiments to those before stated, employing for the decomposition of the distilled water a powerful electrical machine instead of a galvanic battery, but without obtaining results different from what have been already stated *."

It is stated in the same number of the Philosophical Magazine, that the following result was obtained in an experiment on the same subject. By continuing to pass the galvanic fluid from a trough composed of 40 pairs of square inch plates, through distilled water, contained in a glass tube, the tube being furnished at one end with a wire of gold, and at the other with a wire of platina, it was found that a coating of oxide of gold was deposited on the gold wire, from which it is concluded, that oxymuriatic acid was found in the process †. A more particular account was afterwards given by the author of this experiment, and of the precautions he observed in repeating it. He took a clean glass tube, which was bent as in the former experiment; but, instead of the gold wire, he employed one of platina, so that both wires were of the same metal. One of the wires was only introduced a short way into the tube containing the distilled water; the other wire introduced at the other extremity, passed nearly through its whole length, till it reached beyond the point at which the short wire terminated. After the apparatus had stood for three days, with the zinc end of the trough connected with the short platina wire, the latter assumed the colour of gold, and the long one became black from the lower end to the height of the short wire, and continued so for the space of three weeks. The water being diminished one-third, the short wire was connected with the copper end of the trough, and in one day's time the long wire became bright, and the short one black. After two days had elapsed, that part of the long wire which reached to the height of the short one, assumed a yellowish golden tinge. Both the wires remained so for three days, when they were placed in their first situation. The black powder then left the short wire, and the long one became black. A slip of blue test paper being immersed in the remaining water, its colour was changed, which indicates the production of an acid.

ation / uriatic / , &c. | * [...] xxiii. [...] 71 | [...] others. | † [...] 85.

Formation of Muriatic Acid, &c.

Pacchiani, the discoverer, in another letter on this subject addressed to Fabroni, seems to think that those who have failed in obtaining the same results in the decomposition of water, have either been influenced in conducting their experiments by preconceived opinions, or have deviated from the process which he followed. But for an account of his views and reasonings, see *An. de Chim.* tom. lvi. or Phil. Mag. xxiv. 176. We shall only observe, that he still considers himself warranted to draw the same conclusion with regard to the formation of the acid, by the action of galvanism.

Mr Sylvester of Sheffield made the following experiment on this subject. The water which he employed was not changed by adding nitrate of silver. This water was introduced into a tube which was secured at one end with a bit of bladder. At the other end was a cork, through which a wire of platina was passed, nearly to the bottom of the tube. The tube was then set in a wine glass, containing also pure water, and into this was also introduced another wire of platina, the extremity of which came under the end of the tube, and as near as possible to the bladder. The wire within the tube was connected with the zinc end of the trough, and the wire in the glass, which was in contact with the bladder, proceeded from the copper end. After the process had continued for an hour, the liquid in the tube was put to the test of nitrate of silver, and when a sufficient precipitate was obtained, to ascertain the presence of muriatic acid, the liquid in the glass contained an alkali, which the author suspected was ammonia *.

* *Nichol. Journal*, xiv. 97.

Brugnatelli observes, that, after having galvanised several times, both negatively and positively, a certain quantity of pure water with golden wires, inserted in separate tubes, till he found, by the usual tests, that acid was produced on the one part, and alkali on the other, when the two liquids were mixed to perfect saturation, and evaporated in the air, he always obtained muriate of soda crystallized in cubes. He has therefore no doubt, that water negatively and positively galvanised, by means of gold wires, produces or disengages muriatic acid in the one case, and soda in the other †.

† *Phil. Mag.* xxv. 66.

Such are the authorities for this curious phenomenon which we have hitherto had an opportunity of consulting; but although in general it would appear that the experiments made with a view of ascertaining the truth of the discovery announced by Pacchiani, have most generally succeeded, some other experiments, made with the same view, have failed. For this purpose a series of experiments was instituted by the Galvanic Society of Paris, whose attention was directed to endeavour, as well by means of electricity as of galvanism, to confirm this important discovery; but although they employed a very simple apparatus, and one which seemed least susceptible of any foreign influence, they do not think it possible to produce any thing by the action of the galvanic pile, except the decomposition of a greater or less proportion of the water submitted to its action. The water remaining in the tube being carefully examined, produced no effect on the tinctures of turnsole or brazil wood, or the solution of nitrate of silver.

Formation of Muriatic Acid, &c.

silver. Hence it is concluded that neither muriatic acid nor soda was formed in this experiment.

Some other experiments made with the same view have also failed; but according to De Buch, certain precautions seem to be necessary in conducting this experiment, which, if overlooked, it cannot be expected, he thinks, to be followed with success. For the particulars of these, see Phil. Mag. xxiv. 244. For an account of the analogy between the peculiarity of structure of the torpedo, by which it is enabled to give electric shocks, and the galvanic battery, see TORPEDO; and for a full detail of the chemical effects of Galvanism, see ZINC. See also the article GALVANISM in the SUPPLEMENT.

THE following facts, which seem to extend the analogy of galvanism with electricity on the one hand, and with magnetism on the other, were omitted in the preceding treatise.

Ritter, one of the most indefatigable philosophers, in prosecuting experiments and inquiries on this subject, has succeeded in charging a piece of money with the galvanic fluid, and with this some of the phenomena of galvanism can be exhibited. To effect this, he places a louis d'or between two pieces of pasteboard, thoroughly wetted, and keeps it for six or eight minutes in the chain of circulation connected with the pile. In this way the louis becomes charged, without being immediately in contact with the conducting wires. If this louis be afterwards applied to the crural nerves of a frog, recently prepared, the usual contractions will be produced. It is found that the charge is retained, in proportion to the time that the piece has remained in the circuit of the pile. Some have retained it for five minutes. Ritter has also discovered, that the piece of gold thus galvanised, exerts at once the action of two metals; the half next the negative pole, while in the circle, became positive, and the half towards the positive pole became negative. He also tried the effect of golden needles charged with galvanism, and balanced on a pivot, and he perceived, to his surprise, that these needles had a certain dip and variation;—that the angle of variation was uniformly the same, differing, however, from that of the magnetic needle, and that the positive pole always dips*.

If the facts which the above experiments seem to prove, should be fully ascertained, there is an obvious analogy, not only between electricity and galvanism, but also between the latter and magnetism.

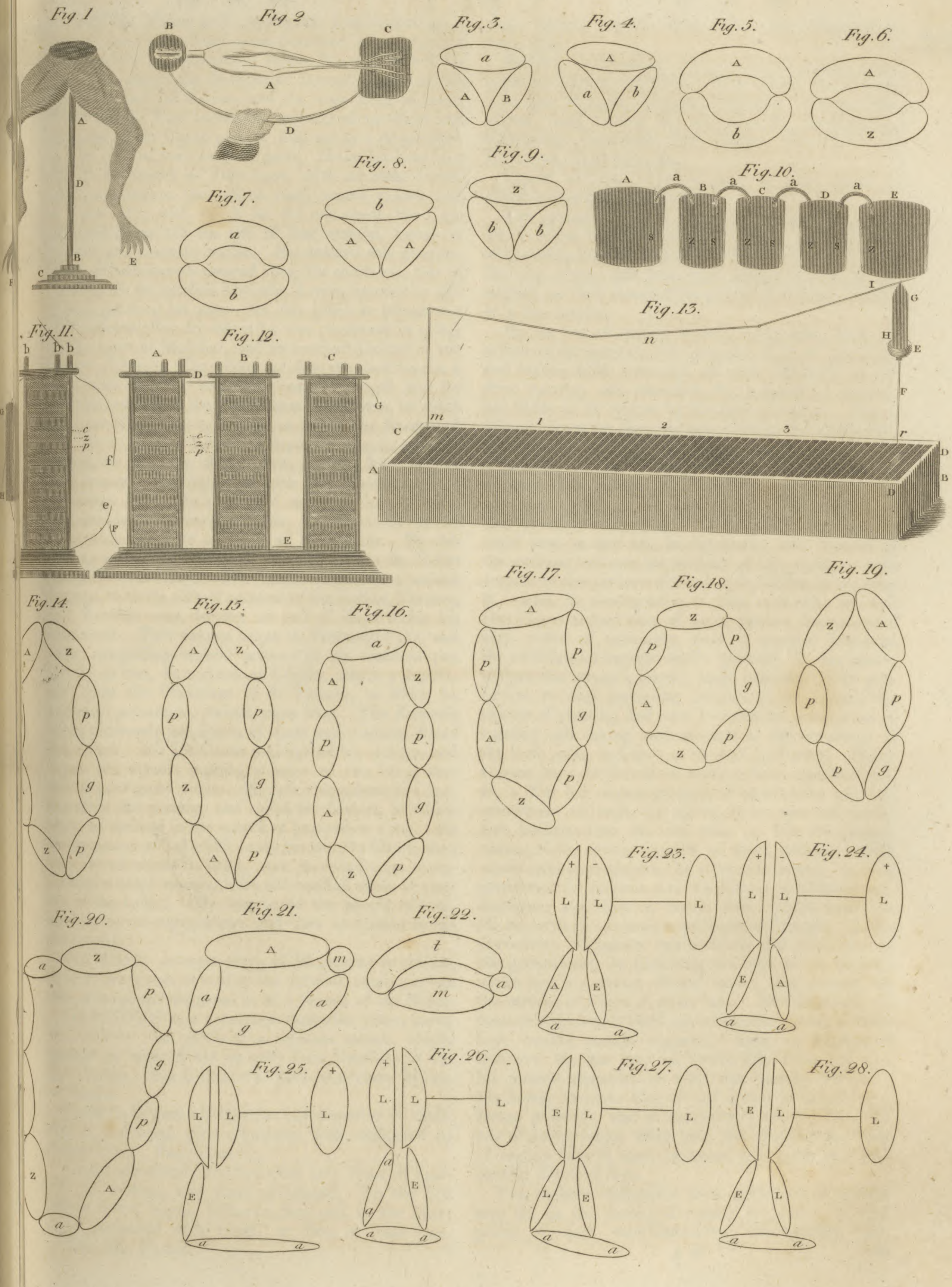
* Nicol. Journ. xii. 99.

A galvanic pile has been constructed by Dr Baronio of Milan, entirely of vegetable matters. For this purpose he cuts discs of horse radish and beet root, of two inches in diameter. He then prepared equal discs of walnut tree wood; the latter discs were raised at their edges, to contain a little solution of acidulous tartrate of potash in vinegar, in which they had been previously boiled to free the wood from rosin. Sixty pairs of discs were employed in the following order; viz. horse radish, beet-root, discs of wood, in each of which the solution was put. The spinal marrow of a prepared frog was connected with the pile, by means of a leaf of *cochlearia*: the muscles of the frog were connected with the top of the pile by means of a double band of gray paper wetted with vinegar, and as often as this circuit was completed, contractions were excited in the animal.

Galway.

GALWAY, or GALLOWAY, a county of Ireland, which is 76 miles in length, and 40 in breadth, bounded by the counties of Clare, Tipperary, King's County, Roscommon, and the sea. The river Shannon washes the frontiers of the east and south-east, and forms a lake several miles in length. This county contained 142,000 inhabitants in 1792. It sends two members to the imperial parliament. See GALWAY, SUPPLEMENT.

GALWAY, a town of Ireland, in the county of the same name, and province of Connaught, of which it is the capital. It is seated on the bay of Galway on the western ocean, 96 miles west of Dublin, and in W. Long. 8. 58. N. Lat. 53. 15. It is surrounded with strong walls; the houses are well built, and the number of inhabitants is about 15,000. It has a good trade into foreign parts, on account of its harbour, which is defended by a fort. It is governed by a mayor, sheriffs, and recorder. It has but one parish church, which is a large and beautiful Gothic structure, an exchange, barracks for 10 companies of foot, a charter school, and an hospital. This was one of the strongest towns in the kingdom; it held out some time against General Ginkle, who invested and took it after the battle of Aughrim. Its fortifications were then repaired. The walls are flanked by bastions, but are mostly gone to decay. The salmon and herring fisheries are carried on here with great spirit, and employ 700 boats; the quantity of kelp manufactured and exported is considerable; and the growth of the linen manufacture, though of late introduction, is become very important. In 1296, Sir William de Burgh founded a monastery here for Franciscan friars, on St Stephen's island, situated without the north gate of the town. In 1381, there being two popes at Rome, and the people of Ireland being doubtful to which they should pay obedience, Pope Urban, to fix them entirely to his interest, empowered the guardian of this monastery to excommunicate every person in the province of Connaught who should adhere to his rival Clement VII. who he assured them was antipope.—Near the west gate of the town, without the walls, was the monastery of St Mary of the Hill: on the nuns forsaking it, the secular clergy entered into and kept possession of it for a considerable time; but on the petition of the inhabitants of the town to Pope Innocent VIII. it was granted to the Dominican friars, by a bull dated the 4th December 1488. There are no remains of this foundation except the cemetery; the whole building having been demolished by the townsmen in the year 1652, in order to prevent Cromwell from turning it into a fortification against themselves: there was also an Augustinian friary, on a hill near this town, founded by Stephen Lynch, and Margaret his wife, in the year 1508, at the earnest solicitation of Richard Nangle, a friar of the same order, who afterwards became bishop of Tuam.



E. Mitchell sculp.t

Gama ‖ Game.

GAMA, Vasco or Vasques de, a celebrated navigator, was born at Sines, a sea-port town in the province of Alentejo, in Portugal. When King Emanuel resolved to extend the discoveries formerly made of the southern parts of Africa, and the seas lying between these and the East Indies, the well-known prudence and courage of De Gama pointed him out as a proper person to conduct such an enterprise. He sailed from Lisbon in the month of July 1497, with no more formidable a squadron than three small armed vessels and a store ship, with which he did not reach the Cape of Good Hope till the end of four months, owing to violent and contrary winds. He doubled this promontory, and afterwards coasted along the south-east side of Africa, till he reached Melinda, having touched at different ports on his way. At this place he procured a Mahometan pilot, by whom he was conducted in safety to the coast of Malabar, and he reached Calicut in the month of May. The prince at first received him in a hospitable manner, but a plot being at length laid for his destruction by the Mahometan merchants, he made the best of his way to Europe as soon as he discovered it. He arrived at Lisbon in September 1499, with the loss of the majority of his crew, arising from fatigue and disease. Having spent some time in devotion at a hermitage, he made a splendid entrance into the city, and besides pecuniary rewards, was honoured by the king with the title of count of Videgueira. By this voyage the practicability of a new passage to the Indies was fully established. De Gama undertook a second voyage, with the title of admiral of the Indian, Persian, and Arabian seas, having 20 sail of ships under his command. This voyage began in February 1502, and after compelling several princes in his route to pay tribute to him, he arrived at Cochin, where a deputation from the Christians of St Thomas, to whom he promised protection, waited upon him. The Zamorin being extremely suspicious of these new visitors, fitted out a fleet; but De Gama anticipated the design, and began the attack, making a prize of two large vessels of prodigious value. He left a squadron at Cananor after this victory, and sailed for Lisbon, at which place he arrived in the month of September 1503. On the accession of John III. to the throne, De Gama, then very far advanced in years, was prevailed upon to undertake a third voyage, with the exalted rank of viceroy of the Indies. He conquered the people of Calicut in a naval engagement, and died at Cochin in the year 1525.

GAMBIA, a large river of Negroland in Africa, running from east to west to the Atlantic ocean; it was once erroneously supposed to be a branch of the Niger.

GAMBOGE is a concreted vegetable juice, partly of a gummy and partly of a resinous nature, chiefly brought in large cakes or rolls from Cambaja in the East Indies. See Chemistry and Materia Medica *Index*.

GAME, in general, signifies any diversion or sport, that is performed with regularity, and conducted by certain rules. See Gaming.

Games are usually distinguished into those of exercise and address, and those of hazard. To the first belong chess, tennis, billiards, &c. and to the latter those performed with cards, or dice, as back-gammon, ombre, piquet, whist, &c. See *Back-Gammon*, &c.

Games, in antiquity, were public diversions, exhibited on solemn occasions. Such among the Greeks were the Olympic, Pythian, Isthmian, Nemean, &c. games; and, among the Romans, the Apollinarian, Circensian, Capitoline, &c. games. See Olympic, Pythian, Funeral, &c.

Game, in *Law*, signifies birds, or prey, taken or killed by fowling or hunting.

The property of such animals *feræ naturæ* as are known under the denomination of *game*, with the right of pursuing, taking, and destroying them, is vested in the king alone, and from him derived to such of his subjects as have received the grants of a chase, a park, or a free warren.

By the law of nature, indeed, every man, from the prince to the peasant, has an equal right of pursuing, and taking to his own use, all such creatures as are *feræ naturæ*, and therefore the property of nobody, but liable to be seized by the first occupant. But it follows, from the very end and constitution of society, that this natural right, as well as many others belonging to man as an individual, may be restrained by positive laws enacted for reasons of state, or for the supposed benefit of the community. This restriction may be either with respect to the *place* in which this right may, or may not, be exercised; with respect to the *animals* that are the subjects of this right; or with respect to the *persons* allowed or forbidden to exercise it. And, in consequence of this authority, we find that the municipal laws of many nations have exerted such power of restraint; have in general forbidden the entering on another man's grounds, for any cause, without the owner's leave; have extended their protection to such particular animals as are usually the objects of pursuit; and have invested the prerogative of hunting and taking such animals in the sovereign of the state only, and such as he shall authorize. Many reasons have concurred for making these constitutions; as, 1. For the encouragement of agriculture and improvement of lands, by giving every man an exclusive dominion over his own soil. 2. For the preservation of the several species of these animals, which would soon be extirpated by a general liberty. 3. For prevention of idleness and dissipation in husbandmen, artificers, and others of lower rank; which would be the unavoidable consequence of universal license. 4. For prevention of popular insurrections and resistance to the government, by disarming the bulk of the people: which last is a reason oftener meant than avowed, by the makers of forest or game laws. Nor certainly, in these prohibitions is there any *natural* injustice, as some have weakly enough supposed: since, as Puffendorf observes, the law does not hereby take from any man his present property, or what was already his own; but barely abridges him of one means of acquiring a future property, that of occupancy; which indeed the law of nature would allow him, but of which the laws of society have in most instances very justly and reasonably deprived him.

Yet, however defensible these provisions in general may be, on the footing of reason, or justice, or civil policy, we must, notwithstanding, acknowledge, that, in

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in their present shape, they owe their immediate original to slavery. It is not till after the irruption of the northern nations into the Roman empire, that we read of any other prohibitions, than that natural one of not sporting on any private grounds without the owner's leave.

With regard to the rise and original of our present civil prohibitions, it will be found, that all forest and game laws were introduced into Europe at the same time, and by the same policy, as gave birth to the feodal system: when those swarms of barbarians issued from their northern hive, and laid the foundation of most of the present kingdoms of Europe, on the ruins of the western empire. For when a conquering general came to settle the economy of a vanquished country, and to part it out among his soldiers or feudatories, who were to render him military service for such donations; it behoved him, in order to secure his new acquisitions, to keep the *rustici* or natives of the country, and all who were not his military tenants, in as low a condition as possible, and especially to prohibit them the use of arms. Nothing could do this more effectually than a prohibition of hunting and sporting: and therefore it was the policy of the conqueror to reserve this right to himself, and such on whom he should bestow it; which were only his capital feudatories, or greater barons. And, accordingly, we find, in the feudal constitutions, one and the same law prohibiting the *rustici* in general from carrying arms, and also proscribing the use of nets, snares, or other engines for destroying the game. This exclusive privilege well suited the martial genius of the conquering troops, who delighted in a sport which in its pursuit and slaughter bore some resemblance to war. *Vita omnis* (says Cæsar, speaking of the ancient Germans) *in venationibus atque in studiis rei militaris consistit.* And Tacitus in like manner observes, that *quoties bella non ineunt, multum venatibus, plus per otium transigunt.* And indeed, like some of their modern successors, they had no other amusement to entertain their vacant hours; for they despised all arts as effeminate, and had no other learning than what was couched in such rude ditties as were sung at the solemn carousals which succeeded these ancient huntings. And it is remarkable, that in those nations where the feodal policy remains the most uncorrupted, the forest or game laws continue in their highest rigour. Formerly in France, all game was properly the king's; and in some parts of Germany it is death for a peasant to be found hunting in the woods of the nobility.

With us, in Britain, also hunting has ever been esteemed a most princely diversion and exercise. The whole island was replenished with all sorts of game in the time of the Britons; who lived in a wild and pastoral manner, without enclosing or improving their grounds; and derived much of their subsistence from the chase, which they all enjoyed in common. But when husbandry took place under the Saxon government, and lands began to be cultivated, improved, and enclosed, the beasts naturally fled into the woody and desert tracts, which were called the *forests;* and, having never been disposed of in the first distribution of lands, were therefore held to belong to the crown. These were filled with great plenty of game, which our royal sportsmen reserved for their own diversion, on pain of a pecuniary forfeiture for such as interfered with their sovereign. But every freeholder had the full liberty of sporting upon his territories, provided he abstained from the king's forests.

However, upon the Norman conquest, a new doctrine took place; and the right of pursuing and taking all beasts of chase or *venary*, and such other animals as were accounted *game*, was then held to belong to the king, or to such only as were authorized under him. And this, as well upon the principles of the feodal law, that the king is the ultimate proprietor of all the lands in the kingdom, they being all held of him as the chief lord, or lord paramount of the fee; and that therefore he has the right of the universal soil, to enter thereon, and to chase and take such creatures at his pleasure: as also upon another maxim of the common law, that these animals are *bona vacantia*, and, having no other owner, belong to the king by his prerogative. As therefore the former reason was held to vest in the king a *right* to pursue and take them anywhere, the latter was supposed to give the king, and such as he should authorise, a *sole* and *exclusive* right.

This right, thus newly vested in the crown, was exerted with the utmost rigour, at and after the time of the Norman establishment; not only in the ancient forests, but in the new ones which the Conqueror made, by laying together vast tracts of country, depopulated for that purpose, and reserved solely for the king's royal diversion; in which were exercised the most horrid tyrannies and oppressions, under colour of forest law, for the sake of preserving the beasts of chase: to kill any of which, within the limits of the forest, was as penal as the death of a man. And, according to the same principle, King John laid a total interdict upon the *winged* as well as the *four-footed* creation; *capturam avium per totam Angliam interdixit**. The cruel and insupportable hardships which these forest laws created to the subject, occasioned our ancestors to be as zealous for their reformation, as for the relaxation of the feodal rigours and the other exactions introduced by the Norman family: and accordingly we find the immunities of *charta de foresta* as warmly contended for, and extorted from the king with as much difficulty, as those of *magna charta* itself. By this charter, confirmed in parliament†, many forests were disafforested, or stripped of their oppressive privileges, and regulations were made in the regimen of such as remained; particularly killing the king's deer was made no longer a capital offence, but only punished by a fine, imprisonment, or abjuration of the realm. And by a variety of subsequent statutes, together with the long acquiescence of the crown without exerting the forest laws, this prerogative is now become no longer a grievance to the subject.

* M. P. 303.

† 9 Hen. III.

But as the king reserved to himself the *forest* for his own exclusive diversion, so he granted out from time to time other tracts of lands to his subjects under the names of *chases* or *parks;* or gave them license to make such in their own grounds; which indeed are smaller forests in the hands of a subject, but not governed by the forest laws; and by the common law no person is at

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at liberty to take or kill any beasts of chase, but such as have an ancient chase or park; unless they be also beasts of prey.

As to all inferior species of game, called *beasts and fowls of warren;* the liberty of taking or killing them is another franchise or royalty, derived likewise from the crown, and called *free warren;* a word which signifies preservation or custody: as the exclusive liberty of taking and killing fish in a public stream or river is called a *free fishery;* of which, however, no new franchise can at present be granted by the express provision of *magna charta*, c. 16. The principal intention of granting a man these franchises or liberties was in order to protect the game, by giving him a sole and exclusive power of killing it himself, provided he prevented other persons. And no man but he who has a chase or free warren, by grant from the crown, or prescription, which supposes one, can justify hunting or sporting upon another man's soil; nor indeed, in thorough strictness of common law, either hunting or sporting at all.

However novel this doctrine may seem, it is a regular consequence from what has been before delivered, that the sole right of taking and destroying game belongs exclusively to the king. This appears, as well from the historical deduction here made, as because he may grant to his subjects an exclusive right of taking them; which he could not do, unless such a right was first inherent in himself. And hence it will follow, that no person whatever, but he who has such derivative right from the crown, is by common law entitled to take or kill any beast of chase, or other game whatsoever. It is true, that by the acquiescence of the crown, the frequent grants of free warren in ancient times, and the introduction of new penalties of late by certain statutes for preserving the game, this exclusive prerogative of the king is little known or considered; every man that is exempted from these modern penalties looking upon himself as at liberty to do what he pleases with the game; whereas the contrary is strictly true, that no man, however well *qualified* he may vulgarly be esteemed, has a right to encroach on the royal prerogative by the killing of game, unless he can shew a particular grant of free warren; or a prescription which presumes a grant; or some authority under an act of parliament. As for the latter; there are but two instances wherein an express permission to kill game was ever given by statute: the one by 1 Jac. I. c. 37. altered by Jac. I. c. 12. and virtually repealed by 22 and 23 Car. II. c. 25. which gave authority, so long as they remained in force, to the owners of free warren, to lords of manors, and to all freeholders having 40l. per annum in lands of inheritance, or 80l. for life or lives, or 400l. personal estate (and their servants), to take partridges and pheasants, upon their own, or their master's free warren, inheritance, or freehold: the other by 5 Ann. c. 14. which empowers lords and ladies of manors to appoint gamekeepers, to kill game for the use of such lord or lady; which with some alteration still subsists, and plainly supposes such power not to have been in them before. The truth of the matter is, that these game laws do indeed *qualify* nobody, except in the instance of a gamekeeper, to kill game: but only to save the trouble and formal process of an action by the person injured, who perhaps too might remit the offence, these statutes inflict *additional* penalties, to be recovered either in a regular or summary way, by any of the king's subjects, from certain persons of inferior rank who may be found offending in this particular. But it does not follow that persons excused from these additional penalties are therefore *authorized* to kill game. The circumstance of having 100l. per annum, and the rest, are not properly qualifications, but exemptions. And these persons so exempted from the penalties of the game statutes, are not only liable to actions of trespass by the owners of the land; but also if they kill game within the limits of any royal franchise, they are liable to the actions of such who may have the right of chase or free warren therein.

Upon the whole it appears, that the king, by his prerogative, and such persons as have, under his authority, the ROYAL FRANCHISE of CHACE, PARK, or *Free WARREN*†, are the *only* persons who may acquire any property, however fugitive and transitory, in these animals *feræ naturæ*, while living; which is said to be vested in them *propter privilegium*. And it must also be observed, that such persons as may thus lawfully hunt, fish, or fowl, *ratione privilegii*, have only a qualified property in these animals; it not being absolute or permanent, but lasting only so long as the creatures remain within the limits of such respective franchise or liberty, and ceasing the instant they voluntarily pass out of it. It is held indeed, that if a man starts any game within his own grounds, and follows it into another's and kills it there, the property remains in himself. And this is grounded on reason and natural justice; for the property consists in the possession; which possession commences by the finding it in his own liberty, and is continued by the immediate pursuit. And so, if a stranger starts game in one man's chase or free warren, and hunts it into another liberty, the property continues in the owner of the chase or warren; this property arising from privilege, and not being changed by the act of a mere stranger. Or if a man starts game on another's private grounds, and kills it there, the property belongs to him in whose ground it was killed, because it was also started there; this property arising *ratione soli*. Whereas if, after being started there, it is killed in the grounds of a third person, the property belongs not to the owner of the first ground, because the property is local; nor yet to the owner of the second, because it was not started in his soil; but it vests in the person who started and killed it; though guilty of a trespass against both the owners. See the article *Game Laws*.

† See those articles.

It will probably be considered by sportsmen who have not an opportunity of seeing the book, as a curious piece of information, to have the following, which we extract from Daniel's Rural Sports, concerning the quantity of game killed in different countries.

"The lists of the game, says he, that has been killed upon particular manors in England by parties, and even by single gentlemen, exhibit such a wanton registry of slaughter, as no sportsman can read without regret; but to prove that *British* are rather more merciful than *French* shooters, the account of the former game establishment at Chantilli is first presented to the reader, in the words of the very ingenious person who recorded it.

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"The game establishment at Chantilli was the most extraordinary establishment of the kind in Europe.

"The following list of the quantity of different kinds of game killed at Chantilli, in a period of 32 years, beginning with the year 1748, and ending with the year 1779, was copied from the household registers there, and what seems unaccountable, never was printed before, not even in France! The copy was taken in 1788, and the statement, as an object in natural history, is no small curiosity, and as such it is philosophically interesting.

Hares . . .	77,750
Rabbits . . .	587,470
Partridges . . .	116,574
Red, ditto . . .	12,426
Pheasants . . .	86,193
Quails . . .	19,696
Ralles . . .	449
Woodcocks . . .	2164
Snipes . . .	2856
Ducks . . .	1353
Wood pigeons . .	317
Curlews . . .	32
Bustards . . .	2
Larks . . .	106
Thrushes . . .	1313
Stags . . .	1682
Hinds . . .	1682
Fawns . . .	519
Does . . .	1921
Young does . .	135
Roe-bucks . . .	4669
Young ditto . .	810
Wild boars . . .	1942
Marcassins . . .	818

Connected with this establishment, there was a park of 21 miles, and a forest of 48 miles in extent, and while the family were at the place, they had 500 horses, as many servants, and from 60 to 80 couple of dogs.

"The Germans too, says Mr Daniel, have a happy knack at a massacre. In 1788 a party of 10 persons at the chateau of Prince Adam Daversperg, in Bohemia, were out five hours on the 9th and 10th of September, allowed that the first day 6168 shots were fired, and 876 hares, 259 pheasants, 362 partridges, beside quails, rabbits, &c. were bagged, or rather waggoned. On the second day 5904 shots were discharged, and 181 hares, 634 pheasants, and 736 partridges were killed, besides some that were picked up in the evening. The number of shots in the two days were 11,972, the game carried home were

Hares	1099
Pheasants	958
Partridges	1201

besides small game. It is added that the birds were all shot on the wing.

"In Germany, during the month of October 1797, Prince Lichtenstein, and eleven other gentlemen, killed in one day, when they were out fourteen hours, 39,000 pieces of game; it was of all sorts, but chiefly hares and partridges. The king of Naples and Sir W. Hamilton killed 800 head of game in the neighbourhood of Casarte, of which 640 were partridges, in a very short space of time.

Game ‖ Gaming.

"Upon Mr Colquhoun's manor in our own country, at Writham in Norfolk, the late duke of Bedford, and six other gentlemen, in 1796, killed 80 cock pheasants, 40 hares, besides partridges, in one day. At Houghton, in the same county, the duke of Bedford, and seven others, killed in the same space, 165 hares, 42 pheasants, 5 rabbits, a couple of woodcocks, and a brace of partridges; and this was done, although the woods had been beat five times before during the season *."

* Vol.

Game Cock, , a fighting cock, or one kept for sport; a barbarous practice, which is a disgrace to any civilized nation. See *Cock-Fighting*.

GAMELIA, in Grecian antiquity, a nuptial feast, or rather sacrifice, held in the ancient Greek families on the day before a marriage; thus called from a custom they had of shaving themselves on this occasion, and presenting their hair to some deity to whom they had particular obligations.

GAMELION, in the ancient chronology, was the eighth month of the Athenian year, containing 29 days, and answering to the latter part of our January and beginning of February. It was thus called, as being, in the opinion of the Athenians, the most proper season of the year for marriage.

GAMING, the art of playing or practising any game, particularly those of hazard; as cards, dice, tables, &c.

Gaming has at all times been looked upon as a thing of pernicious consequence to the commonwealth; and is therefore severely prohibited by law. It is considered as a practice generally intended to supply, or retrieve, the expences occasioned by LUXURY: it being a kind of tacit confession, that the company engaged therein do, in general, exceed the bounds of their respective fortunes; and therefore they cast lots to determine upon whom the ruin shall at present fall, that the rest may be saved a little longer. But taken in any light, it is an offence of the most alarming nature, tending by necessary consequence, to promote public idleness, theft, and debauchery, among those of a lower class; and, among persons of a superior rank, it hath frequently been attended with the sudden ruin and desolation of ancient and opulent families, and abandoned prostitution of every principle of honour and virtue, and too often hath ended in self-murder. To restrain this pernicious vice among the inferior sort of people, the statute 33 Hen. VIII. c. 9. was made; which prohibits to all but gentlemen, the games of tennis, tables, cards, dice, bowls, and other unlawful diversions there specified, unless in the time of Christmas, under pecuniary pains and imprisonment. And the same law, and also the statute 23 Geo. II. c. 24. inflict pecuniary penalties, as well upon the master of any public house wherein servants are permitted to game, as upon the servants themselves, who are found to be gaming there. But this is not the principal ground of modern complaint: it is the gaming in high life that demands the attention of the magistrate; a passion to which every valuable consideration is made a sacrifice, and which we seem to have inherited from our ancestors, the ancient Germans; whom Tacitus describes to have been bewitched with the spirit of play to a most exorbitant

bitant degree. "They addict themselves (says he) to dice (which is wonderful) when sober, and as a serious employment, with such a mad desire of winning or losing, that, when stript of every thing else, they will stake at last their liberty, and their very selves. The loser goes into a voluntary slavery; and, though younger and stronger than his antagonist, suffers himself to be bound and sold. And this perseverance in so bad a cause they call the point of honour: *ea est in re prava pervicacia, ipsi fidem vocant.*" One would almost be tempted to think Tacitus was describing a modern Englishman. When men are thus intoxicated with so frantic a spirit, laws will be of little avail: because the same false sense of honour that prompts a man to sacrifice himself, will deter him from appealing to the magistrate. Yet it is proper that laws should be, and be known publicly, that gentlemen may consider what penalties they wilfully incur, and what a confidence they repose in sharpers; who, if successful in play, are certain to be paid with honour, or if unsuccessful, have it in their power to be still greater gainers by informing. For, by stat. 16 Car. II. c. 7. if any person by playing or betting shall lose more than 100l. at one time, he shall not be compelled to pay the same; and the winner shall forfeit treble the value, one moiety to the king, the other to the informer. The statute 9 Ann. c. 14. enacts, that all bonds and other securities, given for money won at play, or money lent at the time to play withal, shall be utterly void: that all mortgages and encumbrances of lands, made upon the same consideration, shall be and endure to the heir of the mortgager: that, if any person at one time loses 10l. at play, he may sue the winner, and recover it back by action of debt at law; and, in case the loser does not, any other person may sue the winner for treble the sum so lost; and the plaintiff in either case may examine the defendant himself upon oath: and that in any of these suits no privilege of parliament shall be allowed. The statute farther enacts, that if any person cheats at play, and at one time wins more than 10l. or any valuable thing, he may be indicted thereupon, and shall forfeit five times the value, shall be deemed infamous, and suffer such corporal punishment as in case of wilful perjury. By several statutes of the reign of King George II. all private lotteries by tickets, cards, or dice, (and particularly the games of faro, basset, ace of hearts, hazard, passage, rolly polly, and all other games with dice, except backgammon), are prohibited under a penalty of 200l. for him that shall erect such lotteries, and 50l. a-time for the players. Public lotteries, unless by authority of parliament, and all manner of ingenious devices under the denomination of *sales* or otherwise, which in the end are equivalent to lotteries, were before prohibited by a great variety of statutes under heavy pecuniary penalties. But particular descriptions will ever be lame and deficient, unless all games of mere chance are at once prohibited; the invention of sharpers being swifter than the punishment of the law, which only hunts them from one device to another. The stat. 13 Geo. II. c. 19. to prevent the multiplicity of horse races, another fund of gaming, directs, that no plates or matches under 50l. value shall be run, upon penalty of 200l. to be paid by the owner of each horse running, and 100l. by such as advertise the plate. By statute 18 Geo. I. c. 34. the statute 9 Ann. is farther enforced, and some deficiencies supplied: the forfeitures of that act may now be recovered in a court of equity; and, moreover, if any man be convicted, upon information or indictment, of winning or losing at any sitting 10l. or 20l. within 24 hours, he shall forfeit five times the sum. Thus careful has the legislature been to prevent this destructive vice: which may show that our laws against gaming are not so deficient as ourselves and our magistrates in putting those laws in execution.

Chance, or *Hazard*, in *Gaming*. Hazard, or chance, is a matter of mathematical consideration, because it admits of more and less. Gamesters either set out upon an equality of chance, or are supposed to do so. This equality may be altered in the course of the game, by the greater good fortune or address of one of the gamesters, whereby he comes to have a better chance, so that his share in the stakes is proportionably better than at first. This more and less runs through all the ratios between equality and infinite difference, or from an infinitely little difference till it come to an infinitely great one, whereby the game is determined. The whole game, therefore, with regard to the issue of it, is a chance of the proportion the two shares bear to each other.

The probability of an event is greater or less, according to the number of chances by which it may happen, compared with the number of all the chances by which it may either happen or fail.

M. de Moivre, in a treatise *de Mensura Sortis*, has computed the variety of chances in several cases that occur in gaming, the laws of which may be understood by what follows.

Suppose p the number of cases in which an event may happen, and q the number of cases wherein it may not happen, both sides have the degree of probability, which is to each other as p to q.

If two gamesters, A and B, engage on this footing, that, if the cases p happen, A shall win; but if q happen, B shall win, and the stake be a; the chance of A will be $\frac{pa}{q+p}$, and that of B $\frac{qa}{p+q}$; consequently, if they sell the expectancies, they should have that for them respectively.

If A and B play with a single dice, on this condition, that, if A throw two or more aces at eight throws, he shall win; otherwise B shall win; What is the ratio of their chances? Since there is but one case wherein an ace may turn up, and five wherein it may not, let $a=1$, and $b=5$. And again, since there are eight throws of the die, let $n=8$; and you will have $\overline{a+b}|^n - b^n - nab^{n-1}$, to $b^n + nab^{n-1}$: that is, the chance of A will be to that of B as 663991 to 1015625, or nearly as 2 to 3.

A and B are engaged at single quoits; and, after playing some time, A wants 4 of being up, and B 6; but B is so much the better gamester, that his chance against A upon a single throw would be as 3 to 2; What is the ratio of their chances? Since A wants 4, and B 6, the game will be ended at nine throws; therefore, raise $a+b$ to the ninth power, and it will be $a^9+9a^8b+36a^7bb+84a^6b^3+126a^5b^4+126a^4b^5$ to $84a^3b^6+36aab^7+6ab^3+b^9$: call a 3, and b 2, and you will have the ratio of chances in numbers, viz. 1759077 to 194048.

A

A and B play at single quoits, and A is the best gamester, so that he can give B 2 in 3: What is the ratio of their chances at a single throw? Suppose the chances as z to 1, and raise $z+1$ to its cube, which will be z^3+3z^2+3z+1. Now since A could give B 2 out of 3, A might undertake to win three throws running; and consequently the chances in this case will be as z^3 to $3z^2+3z+1$. Hence $z^3=3z^2+3z+1$; or $2z^3=z^3+3z^2—3z+1$. And therefore $z\sqrt[3]{2}=z+1$; and, consequently, $z=\frac{1}{\sqrt[3]{2}-1}$. The chances, therefore, are $\frac{1}{\sqrt[3]{2}-1}$, and 1, respectively.

Again, suppose I have two wagers depending, in the first of which I have 3 to 2 the best of the lay, and in the second 7 to 4; What is the probability I win both wagers?

1. The probability of winning the first is $\frac{3}{5}$, that is, the number of chances I have to win, divided by the number of all the chances: the probability of winning the second is $\frac{7}{11}$: therefore, multiplying these two fractions together, the product will be $\frac{21}{55}$, which is the probability of winning both wagers. Now, this fraction being subtracted from 1, the remainder is $\frac{34}{55}$, which is the probability I do not win both wagers: therefore the odds against me are 34 to 21.

2. If I would know what the probability is of winning the first, and losing the second, I argue thus; the probability of winning the first is $\frac{3}{5}$, the probability of losing the second is $\frac{4}{11}$: therefore multiplying $\frac{3}{5}$ by $\frac{4}{11}$, the product $\frac{12}{55}$ will be the probability of my winning the first and losing the second; which being subtracted from 1, there will remain $\frac{43}{55}$, which is the probability I do not win the first, and at the same time lose the second.

3. If I would know what the probability is of winning the second, and at the same time losing the first, I say thus: The probability of winning the second is $\frac{7}{11}$; the probability of losing the first is $\frac{2}{5}$: therefore, multiplying these two fractions together, the product $\frac{14}{55}$ is the probability I win the second, and also lose the first.

4. If I would know what the probability is of losing both wagers, I say, the probability of losing the first is $\frac{2}{5}$, and the probability of losing the second $\frac{4}{11}$: therefore the probability of losing them both is $\frac{8}{55}$: which, being subtracted from 1, there remains $\frac{47}{55}$: therefore, the odds of losing both wagers is 47 to 8.

This way of reasoning is applicable to the happening or failing of any events that may fall under consideration. Thus if I would know what the probability is of missing an ace four times together with a die, this I consider as the failing of four different events. Now the probability of missing the first is $\frac{5}{6}$, the second is also $\frac{5}{6}$, the third $\frac{5}{6}$, and the fourth $\frac{5}{6}$; therefore the probability of missing it four times together is $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{625}{1296}$; which being subtracted from 1, there will remain $\frac{671}{1296}$ for the probability of throwing it once or oftener in four times: therefore the odds of throwing an ace in four times, is 671 to 625.

But if the flinging of an ace was undertaken in three times, the probability of missing it three times would be $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{125}{216}$; which being subtracted from 1, there will remain $\frac{91}{216}$ for the probability of throwing it once or oftener in three times: therefore the odds against throwing it in three times are 125 to 91. Again, suppose we would know the probability of throwing an ace once in four times, and no more; since the probability of throwing it the first time is $\frac{1}{6}$, and of missing it the other three times, is $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}$, it follows, that the probability of throwing it the first time, and missing it the other three successive times, is $\frac{1}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{125}{1296}$; but because it is possible to hit every throw as well as the first, it follows, that the probability of throwing it once in four throws, and missing it the other three, is $\frac{4\times125}{1296}=\frac{500}{1296}$; which being subtracted from 1, there will remain $\frac{796}{1296}$ for the probability of throwing it once, and no more, in four times. Therefore, if one undertake to throw an ace once, and no more, in four times, he has 500 to 796 the worst of the lay, or 5 to 8 very near.

Suppose two events are such, that one of them has twice as many chances to come up as the other; what is the probability that the event which has the greater number of chances to come up, does not happen twice before the other happens once, which is the case of flinging 7 with two dice before 4 once? Since the number of chances is as 2 to 1, the probability of the first happening before the second is $\frac{2}{3}$, but the probability of its happening twice before it is but $\frac{2}{3}\times\frac{2}{3}$ or $\frac{4}{9}$: therefore it is 5 to 4, seven does not come up twice before four once.

But, if it were demanded, what must be the proportion of the facilities of the coming up of two events, to make that which has the most chances come up twice, before the other comes up once? The answer is, 12 to 5 very nearly: whence it follows, that the probability of throwing the first before the second is $\frac{12}{17}$, and the probability of throwing it twice is $\frac{12}{17}\times\frac{12}{17}$, or $\frac{144}{289}$; therefore the probability of not doing it is $\frac{145}{289}$; therefore the odds against it are as 145 to 144, which comes very near an equality.

Suppose there is a heap of thirteen cards of one colour, and another heap of thirteen cards of another colour; What is the probability, that, taking one card at a venture out of each head, I shall take out the two aces?

The probability of taking the ace out of the first heap is $\frac{1}{13}$; the probability of taking the ace out of the second heap is $\frac{1}{13}$; therefore the probability of taking out both aces is $\frac{1}{13}\times\frac{1}{13}=\frac{1}{169}$, which being subtracted from 1, there will remain $\frac{168}{169}$: therefore the odds against me are 168 to 1.

In cases where the events depend on one another, the manner of arguing is somewhat altered. Thus, suppose that out of one single heap of thirteen cards of one colour I should undertake to take out first the ace; and, secondly, the two: though the probability of taking out the ace be $\frac{1}{13}$, and the probability of taking out the two be likewise $\frac{1}{13}$: yet, the ace being supposed as taken out already, there will remain only twelve cards in the heap, which will make the probability of taking out the two to be $\frac{1}{12}$; therefore the probability of taking out the ace, and then the two, will be $\frac{1}{13}\times\frac{1}{12}$.

In this last question the two events have a dependence on each other; which consists in this, that one of the events

events being supposed as having happened, the probability of the other's happening is thereby altered. But the case is not so in the two heaps of cards.

If the events in question be n in number, and be such as have the same number a of chances by which they may happen, and likewise the same number b of chances by which they may fail, raise $a+b$ to the power n. And if A and B play together, on condition that if either one or more of the events in question happen, A shall win, and B lose, the probability of A's winning will be $\frac{\overline{a+b}|^n - b^n}{\overline{a+b}|^n}$, and that of B's winning will be $\frac{b^n}{\overline{a+b}|}$; for when $a+b$ is actually raised to the power n, the only term in which a does not occur is the last b^n: therefore all the terms but the last are favourable to A.

Thus if $n=3$, raising $a+b$ to the cube $a^3+3a^2b+3ab^2+b^3$, all the terms but b^3 will be favourable to A; and therefore the probability of A's winning will be $\frac{a^3+3a^2b+3ab^2}{\overline{a+b}|}$, or $\frac{\overline{a+b}|^3 - b^3}{\overline{a+b}|^3}$; and the probability of B's winning will be $\frac{b^3}{\overline{a+b}|^3}$. But if A and B play on condition, that if either two or more of the events in question happen, A shall win; the probability of A's winning will be $\frac{\overline{a+b}|^n - nab^{n-1} - {}^n}{\overline{n+b}|^n}$; for the only two terms in which $a\,a$ does not occur are the two last, viz. nab^{n-1} and b^n.

GAMMONING, among seamen, denotes several turns of a rope taken round the bowsprit, and reeved through holes in knees of the head, for the greater security of the bowsprit.

GAMMUT, Gamut, *Gam-ut*, in *Music*, a scale whereon we may learn to sound the musical notes, *ut*, *re*, *mi*, *fa*, *sol*, *la*, in their several orders and dispositions. See Music.

The invention of this scale is owing to Guido Aretin, a monk of Arezzo, in Tuscany, about the year 1009; though it is not so properly an invention, as an improvement on the diagram or scale of the ancients. See Aretin.

Several alterations have been made in the gammut. M. Le Maire, particularly, has added a seventh note; viz. *si*; and the English usually throw out both *ut* and *si*, and make the other five serve for all.

GANDER, in *Ornithology*, the male of the goose kind. See Anas, Ornithology *Index*.

GANG-way, is the several passages or ways from one part of the ship to the other; and whatsoever is laid in any of those passages is said to lie in the gangway.

GANGANELLI. See Clement XIV.

GANGES, a large and celebrated river of India. It has its source in the mountains which border on Little Thibet, in 78 degrees of longitude, and 32 of latitude. It crosses several kingdoms, running from northwest to south-east; and falls into the bay of Bengal by several mouths. The waters are lowest in April and May, and highest before the end of September. It overflows yearly like the Nile; and renders the kingdom of Bengal as fruitful as that of the Delta in Egypt. The people in these parts hold the water of this river in high veneration; and it is visited annually by a prodigious number of pilgrims from all parts of India. The greatest happiness that many of the Indians wish for, is to die in this river. The English have several settlements on this river, which will be taken notice of in their proper places.

GANGLION, in *Anatomy*, denotes a knot frequently found in the course of the nerves, and which is not morbid; for wherever any nerve sends out a branch, or receives one from another, or where two nerves join together, there is generally a ganglion or plexus, as may be seen at the beginning of all the nerves of the medulla spinalis, and in many other places of the body.

Ganglion, in *Surgery*, a hard tubercle, generally moveable, in the external or internal part of the carpus, upon the tendons or ligaments in that part; usually without pain to the patient.

GANGRENE, a very great and dangerous degree of inflammation, wherein the parts affected begin to corrupt, and put on a state of putrefaction. See Medicine, and Surgery.

GANNET, or *Soland Goose*, in *Ornithology*. See Pelicanus, Ornithology *Index*.

GANTLET, or Gauntlet, a large kind of glove made of iron, and the fingers covered with small plates. It was formerly worn by the cavaliers, when armed at all points. The word is derived of the French *guntelet*; and that from *gand*, or *gant*, "glove."

The casque and gauntlets were always borne in the ancient marches in ceremony. Gauntlets were not introduced till about the 13th century.

The gauntlet was frequently thrown like the glove, by way of challenge.

GANTLOPE. See Gauntlope.

GANYMEDE, in mythology, a beautiful youth of Phrygia, son of Tros and brother to Ilus; according to Lucian, he was the son of Dardanus. Jupiter was charmed with him; and carrying him away, made him his cupbearer in the room of Hebe. Some say that he caused him to be carried away by an eagle, and others affirm he was himself the ravisher under the form of that bird. He deified this youth; and to comfort his father made a present to him of some of those very swift horses upon which the gods rode.

GAOL (*Gaola*, Fr. *Geole*, i. e. *Caveola*, "a cage for birds"), is used metaphorically for a prison. It is a strong place or house for keeping of debtors, &c. and wherein a man is restrained of his liberty to answer an offence done against the law: and every county hath two gaols, one for debtors, which may be any house where the sheriff pleases; the other for the peace and matters of the crown, which is the county gaol.

If a gaol be out of repair, or insufficient, &c. justices of peace, in their quarter sessions, may contract with workmen for the rebuilding or repairing it; and by their warrant order the sum agreed on for that purpose to be levied on the several hundreds, and other divisions in the county, by a just rate, 11 and 12 Will. III. c. 19. See Prison.

Gaol Delivery. The administration of justice being originally in the crown, in former times our kings in in person rode through the realm once in seven years, to judge of and determine crimes and offences; afterwards justices in eyre were appointed; and since, justices of assize and goal delivery, &c. A commission of gaol delivery, is a patent in nature of a letter from the king to certain persons, appointing them his justices, or two or three of them, and authorizing them to deliver his gaol, at such a place, of the prisoners in it: for which purpose it commands them to meet at such a place, at the time they themselves shall appoint; and informs them, that, for the same purpose, the king hath commanded his sheriff of the same county to bring all the prisoners of the gaol, and their attachments, before them at the day appointed.

The justices of gaol delivery are empowered by the common law to proceed upon indictments of felony, trespass, &c. and to order to execution or reprieve: they may likewise discharge such prisoners, as on their trials are acquitted, and those against whom, on proclamation being made, no evidence has appeared: they have authority to try offenders for treason, and to punish many particular offences, by statute, 2 *Hawk.* 24. 2. *Hale's Hist. Placit. Cor.* 35.

GAOLER, the keeper of a gaol or prison. Sheriffs are to make such gaolers for whom they will be answerable: but if there be any default in the gaoler, an action lies against him for an escape, &c. yet the sheriff is most usually charged; 2d Inst. 592. Where a gaoler kills a prisoner by hard usage, it is felony; 3d Inst. 52. No fee shall be taken by gaolers, but what is allowed by law, and settled by the judges, who may determine petitions against their extortions, &c. 2 Geo. II. c. 22.

GAONS, a certain order of Jewish doctors, who appeared in the East, after the closing of the Talmud. The word *Gaons* signifies "excellent, sublime;" as in the divinity schools we formerly had Irrefragable, Sublime, Resolute, Angelic, and Subtile doctors. The Gaons succeeded the Seburæans or Opiners about the beginning of the sixth century. Chanan Meischtia was the head and first of the excellents. He restored the academy of Pandebita, which had been shut up for 30 years.

GAR FISH, *Horn Fish*, or *Sea Needle*. See Esox, Ichthyology *Index*.

GARAMA, in *Ancient Geography*, the capital of the Garamantes in Libya Interior; near the springs of the Cinyphus, now in ruins. Garamantes the people. It lay to the south of Gætulia, extending from the springs of the Cinyphus, and the adjacency of the river Gir, to the mountains which form at the *Vallis Garamantica* (Pliny): or from the springs of the Bagrades to the lake Nuba (Ptolemy).

GARAMOND, Claude, a very ingenious letter-founder, was born at Paris; where he began, in the year 1510, to found his printing types free from all the remains of the Gothic, or (as it is generally called) the *black letter*, and brought them to such perfection, that he had the glory of surpassing all who went before him, and of being scarcely ever excelled by his successors in that useful art. His types were prodigiously multiplied: both by the great number of matrices he struck, and the types formed in resemblance of his in all parts of Europe. Thus in Italy, Germany, England, and Holland, the booksellers, by way of recommending their books, distinguished the type by his name; and in particular the small Roman was by way of excellence known among the printers of these nations by the name of *Garamond's small Roman*. By the special command of King Francis I. he founded three sizes of Greek types for the use of Robert Stephens, who with them printed all his beautiful editions of the New Testament, and other Greek authors. He died at Paris in 1561.

GARASSE, Francis, a remarkable Jesuitical writer, the first author of that irreconcilable enmity that still subsists between the Jesuits and Jansenists, in the church of Rome, was born at Angoulesme in 1585, and entered the Jesuits college in 1600. As he had a quick imagination, a strong voice, and a peculiar turn to wit, he became a popular preacher in the chief cities of France; but not content with this honour, he distinguished himself still more by his writings, which were bold, licentious, and produced much controversy. The most considerable in its consequences was entitled *La somme theologique des veritez capitales de la religion Cretienne*; which was first attacked by the abbot of St Cyran, who observing in it a prodigious number of falsifications of the Scriptures and of the fathers, besides many heretical and impious opinions, conceived the honour of the church required him to undertake a refutation. Accordingly he published a full answer to it; while Garassé's book was also under examination of the doctors of the Sorbonne, by whom it was afterwards condemned. Garasse replied to St Cyran; but the two parties of Jesuits and Jansenists, of whom these were respectively the champions, grew to an implacable animosity against each other, that is not even now likely to subside. The Jesuits were forced to remove their brother to a distance from Paris; where, probably weary of his inactive obscurity, when the plague raged at Poictiers in 1631, he begged leave of his superior to attend the sick, in which charitable office he caught the disorder, and died.

GARBE, in *Heraldry*, a sheaf of any kind of grain, borne in several coats of arms, and said to represent summer, as a bunch of grapes does autumn.

GARBLE, a word used to signify the action of separating the dross and dust from spice, drugs, &c. *Garbling* is the cleansing and purifying the good from the bad; and may come from the Italian *garbo*; i. e. finery or neatness: and hence, probably, we say, when we see a man in a neat habit, that he is in handsome *garb*.

GARCILASSO de la Vega, an eminent Spanish poet, was born at Toledo, in 1503. He was the younger son of a man of rank, who had been employed in negociating business of importance. Garcilasso was distinguished for his wit and bravery, and in a particular manner for his poetical talents. He was chiefly instrumental in giving popularity to an innovation of his friend Boscan, who introduced measures borrowed from the Italians. His works consist chiefly of pastorals, which have a tedious prolixity. He is chiefly noted for tenderness, which is remarkably conspicuous in some of his sonnets. He is freer of bombast than the generality of his countrymen, owing to his familiar acquaintance with the ancients; and it is said that his learning and taste were superior to his genius. He followed the profession of arms, and attended Charles V. in in a number of his expeditions. He lost his life at the attack of a fortress in Provence, when only 33 years of age. Garcilasso is also the name of an author, a native of Cusco in Peru, who composed a history of Florida in Spanish, and another of Peru and its Incas.

GARCINIA, a genus of plants belonging to the dodecandria class; and in the natural method ranking under the 18th order, *Bicornes*. See BOTANY *Index*.

GARCON, or GARSOON, a French term, literally signifying a boy, but also applied to divers inferior officers, amongst us called *groom, garçiones*.

GARD, a department in the south of France. The north part which lies among the Cevennes is rugged and barren; but the south part is fertile and populous. It contains mines of copper, lead, iron, and pit coal. The whole number of inhabitants in 1815 was 322,000, of whom about one half were Protestants. Nismes is the chief town.

GARDANT, or GUARDANT, in *Heraldry*, denotes any beast full faced, and looking right forward.

GARDEN, FRANCIS, better known to the public by the title of *Lord Gardenstone*, was born at Edinburgh June 24th, in the year 1721. His father was Alexander Garden of Troup, an opulent landholder in Aberdeenshire; his mother was Jane, daughter of Sir Francis Grant of Cullen, S. C. I.

After passing through the usual course of liberal education at the school and the university, he betook himself to the study of law for his profession; and in the year 1744 he was admitted a member of the Faculty of Advocates, and called to the Scottish bar.

In his practice as an advocate he soon began to be distinguished, by a strong native rectitude of understanding; by that vivacity of apprehension and imagination which is commonly denominated *genius;* by manly candour in argument, often more persuasive than subtlety and sophistical artifice; by powers which, with diligence, might easily attain to the highest eminence of the profession. But the same strength, openness, and ardour of mind, which distinguished him so advantageously among the pleaders at the bar, tended to give him a fondness for the gay enjoyments of convivial intercourse, which was unfavourable to his progress in juridical erudition. Shining in the social and convivial circle, he became less solicitously ambitious than he might otherwise have been, of the character of an eloquent advocate, or of a profound and learned lawyer. The vivacity of his genius was averse from austere and plodding study, while it was captivated by the fascinations of polite learning, and of the fine arts. Nor did he always escape those excesses in the pursuit of pleasure into which the temptations of opening life are apt, occasionally, to seduce the most liberal and ingenuous youth. But his cheerful conviviality, his wit, humour, taste, good-nature, and benevolence of heart, rendered him the delight of all his acquaintance. He became his majesty's solicitor July 3d, 1764.

At length the worth of his character, and his abilities as a lawyer, recommended him to the office of a judge in the courts of session and justiciary, the supreme judicatures, civil and criminal, for Scotland. His place in the court of session he continued to occupy till his death; but had, some years before, resigned the office of a commissioner of justiciary, and in recompense got a pension of 200l. per annum. Clear discernment, strong good sense, conscientious honesty, and amiable benevolence, remarkably distinguished all his opinions and conduct as a judge.

In the year 1762 he purchased the estate of Johnston, in the county of Kincardine. Within a few years after he began to attempt a plan of the most liberal improvement of the value of this estate, by an extension of the village of Laurencekirk, adjoining. He offered leases of small farms, and of ground for building upon, which were to last for the term of one hundred years; and of which the conditions were extremely inviting to the labourers and tradesmen of the surrounding country. These offers were eagerly listened to. More desirous to make the attempt beneficial to the country than to derive profit from it to himself, he was induced, within a few years, to reduce his groundrents to one-half of the original rate.—Weavers, joiners, shoemakers, and other artisans in a considerable number, resorted to settle in the rising village. His lordship's earnestness for the success of his project, and to promote the prosperity of the good people whom he had received under his protection, led him to engage in several undertakings; by the failure of which he incurred considerable losses. Projects of a printfield, and of manufactures of linen and of stockings, attempted with sanguine hopes in the new village, and chiefly at his lordship's risk and expence, misgave in such a manner as might well have finally disgusted a man of less steady and ardent philanthropy with every such engagement. But the village still continued to advance. It grew up under his lordship's eye, and was the favourite object of his care. In the year 1779, he procured it to be erected into a burgh of barony; having a magistracy, an annual fair, and a weekly market. He provided in it a good inn for the reception of travellers; and with an uncommon attention to the entertainment of the guests who might resort to it, furnished this inn with a library of books for their amusement. He invited an artist for drawing, from the continent, to settle at Laurencekirk. He had the pleasure of seeing a considerable linen-manufacture at length fixed in it. A bleachfield was also established as a natural counterpart to the linen manufacture. Before his lordship's death, he saw the plan of improving the condition of the labourers, by the formation of a new village at Laurencekirk, crowned with success beyond his most sanguine hopes. He has acknowledged, with an amiable frankness, in a memoir concerning this village, "That he had tried, in some measure, a variety of the pleasures which mankind pursue; but never relished any so much as the pleasure arising from the progress of his village."

In the year 1785, upon the death of his elder brother, Alexander Garden of Troup, M. P. for Aberdeenship, Lord Gardenstone succeeded to the possession of the family estates, which were very considerable. Until this time his lordship's income had never been more than adequate to the liberal expence into which his rank, and the generosity of his nature, unavoidably led him. But the addition of a fortune of about three thousand pounds a-year to his former revenue, gave him the power of performing many acts of beneficence with which he could not before gratify his good heart. It was happy, likewise, that his succession to this ample income, at a period when the vigour of

Garden. of his constitution was rapidly yielding to the infirmities of old age, enabled him to seek relief, by a partial cessation from business, by travel, and by other means, which could not have been easily compatible with the previous state of his fortune.

In the month of Sept. 1786, he set out from London for Dover, and passed over into France. After visiting Paris, he proceeded to Provence, and spent the winter months in the genial climate of Hieres. In the spring of 1787 he returned northwards, visiting Geneva, Switzerland, the Netherlands, and the Dutch provinces, and passing through Germany into Italy. With a fond curiosity, attentive alike to the wonders of nature, to the noble monuments of the arts, and to the awful remains of ancient grandeur, with which Italy abounds, he visited all its great cities, and surveyed almost every remarkable and famous scene that it exhibits.

His first object, in these travels, was to obtain the restoration of his declining health by the influence of a milder climate, by gentle, continued, and varied exercise; by that pleasing exhilaration of the temper and spirits, which is the best medicine to health, and is most successfully produced by frequent change of place, and of the objects of attention. But the curiosities of nature and art, in those countries through which he travelled, could not fail to attract, in a powerful manner, the curiosity of a mind cultivated and ingenious as his. He, whose breast glowed with the most ardent philanthropy, could not view the varied works and manners of a diversity of nations of his fellow men, without being deeply interested by all those circumstances which might appear to mark their fortunes as happy or wretched. He eagerly collected specimens of the spars, the shells, the strata of rocks, and the veins of metals, in the several countries through which he passed. He amassed also cameos, medals, and paintings. He enquired into science, literature, and local institutions. He wrote down his observations, from time to time; not indeed with the minute care of a pedant, or the ostentatious labour of a man travelling with a design to publish an account of his travels; but simply to aid memory and imagination in the future remembrance of objects useful or agreeable.

After an absence of about three years, he returned to his native country. The last years were spent in the discharge of the duties of his office as a judge; in social intercourse with his friends, among whom was the venerable Lord Monboddo, and others of the most respectable characters that our country has to boast of; in the performance of a thousand generous offices of benevolence and humanity; in cherishing those fine arts, of which he was an eminent admirer and judge; and above all, in promoting the comfort, and encouraging the industry of his dependants, and in lending his aid to every rational attempt at the improvement of public economy and public virtue.

St Bernard's Well, in the neighbourhood of Edinburgh, had been, long since, distinguished for the medicinal virtues of its waters. But various circumstances had also concurred of late to throw it into neglect. Yet its waters being strongly mineralized by a sulphurated hydrogenous gas, were, by this means, unquestionably qualified to operate, with highly beneficial effects, in the cure of various diseases. The qualities of this mineral water falling under Lord Gardenstone's notice, he was induced to purchase the property of the well, to direct it to be cleared from surrounding obstacles, which contaminated the virtues of the water, or made it inaccessible; to erect a beautiful and commodious edifice over it; and to appoint proper persons to distribute the water, for a very trivial compensation to the public. The well lies at a distance from Edinburgh, which is very convenient for a summer morning's walk. Within the few years which have passed since Lord Gardenstone's benevolent care brought it into notice, it has attracted many of the inhabitants of that city to visit it in the mornings of spring and summer. And, undoubtedly, the agreeable exercise to which they have thus been allured, and the salutary effects of the water, have contributed, in no mean degree, to dispel disease, and to confirm or re-establish health. Such monuments are worthy to preserve the memory of a patriotic and a good man!

As an amusement for the last two or three years of his life, when his increasing infirmities precluded him from more active exercise, and from mingling so frequently in the society of his friends as was agreeable to his social and convivial temper, he bethought himself of revising some of the *jeux d'esprit*, and light fugitive pieces, in which he had indulged the gaiety of his fancy, in his earlier days; and a small volume of poems was published, in which the best pieces are, upon good authority, ascribed to Lord Gardenstone. He revised also the memorandums which he had made upon his travels, and permitted them to be sent to press. The two former volumes were published one after another while his lordship was yet alive; the third after his death. They met with a very favourable reception in the world, and were honoured with the high approbation of the most respectable writers of periodical criticism. They convey much agreeable information, and bespeak an elegant, enlightened, and amiable mind. The last volume is filled chiefly with memorandums of his lordship's travels in Italy; and contains many interesting criticisms upon some of the noblest productions of the fine arts of painting and sculpture.

His lordship's health had long been declining; and he died a bachelor on the 22d of July 1793, lamented by his relations and friends, by his tenants and humble dependents, and by all true patriots and good men to whom his merits and virtues were known.

Garden, a piece of ground properly laid out, cultivated and ornamented with a variety of plants, flowers, fruits, &c. See Gardening.

Gardens are usually distinguished into flower garden, fruit garden, and kitchen garden: the first of which, being designed for pleasure and ornament, is to be placed in the most conspicuous part, that is, next to the back front of the house; and the two latter, being designed for use, should be placed less in sight. But though the fruit and kitchen gardens are here mentioned as two distinct gardens, yet they are now usually in one; and that with good reason, since they both require a good soil and exposure, and equally require to be placed out of the view of the house.

In the choice of a place proper for a garden, the most essential points to be considered are, the situation, the soil, the exposure, water, and prospect.

1st, As to the situation, it ought to be such a one as as is wholesome, and in a place neither too high nor too low; for if a garden be too high, it will be exposed to the winds, which are very prejudicial to trees; and if it be too low, the dampness, the vermine, and the venomous creatures that breed in ponds and marshy places, add much to their insalubrity. The most happy situation is on the side of a hill, especially if the slope be easy, and in a manner imperceptible; if a good deal of level ground be near the house; and if it abounds with springs of water: for, being sheltered from the fury of the winds and the violent heat of the sun, a temperate air will be there enjoyed; and the water that descends from the top of the hill, either from springs or rain, will not only supply fountains, canals, and cascades for ornament, but, when it has performed its office, will water the adjacent valleys, and, if it be not suffered to stagnate, will render them fertile and wholesome.

2dly, A good earth or soil is next to be considered; for it is scarce possible to make a fine garden in a bad soil. There are indeed ways to meliorate ground, but they are very expensive; and sometimes, when the expence has been bestowed of laying good earth three feet deep over the whole surface, a whole garden has been ruined, when the roots of the trees have come to reach the natural bottom. To judge of the quality of the soil, observe whether there be any heath, thistles, or such like weeds, growing spontaneously in it; for they are certain signs that the ground is poor. Or if there be large trees growing thereabouts, observe whether they grow crooked, ill-shaped, and grubby; and whether they are of a faded green, and full of moss, or infested with vermine: if this be the case, the place is to be rejected. But, on the contrary, if it be covered with good grass fit for pasture, you may then be encouraged to try the depth of the soil. To know this, dig holes in several places, six feet wide and four deep; and if you find three feet of good earth it will do very well, but less than two will not be sufficient. The quality of good ground, is neither to be stony nor too hard to work; neither too dry, too moist, nor too sandy and light; nor too strong and clayey, which is the worst of all for gardens.

3dly, The next requisite is water; the want of which is one of the greatest inconveniences that can attend a garden, and will bring a certain mortality upon whatever is planted in it, especially in the greater droughts that often happen in a hot and dry situation in summer; besides its usefulness in fine gardens for making fountains, canals, cascades, &c. which are the greatest ornaments of a garden.

4thly, The last thing to be considered is the prospect of a fine country; and though this is not so absolutely necessary as water, yet it is one of the most agreeable beauties of a fine garden: besides, if a garden be planted in a low place that has no kind of prospect, it will not only be disagreeable but unwholesome.

In the laying out and planting of gardens, the beauties of nature should always be studied; for the nearer a garden approaches to nature, the longer it will please. According to Mr Miller, the area of a handsome garden may take up 30 or 40 acres, but not more; and the following rules should be observed in the disposition of it. There ought always to be a descent of at least three steps from the house to the gardens; this will render the house more dry and wholesome, and the prospect on entering the garden more extensive.—The first thing that ought to present itself to view should be an open lawn of grass, which ought to be considerably broader than the front of the buildings; and if the depth be one half more than the width, it will have a better effect: if on the sides of the lawn there are trees planted irregularly, by way of open groves, the regularity of the lawn will be broken, and the whole rendered more like nature. For the convenience of walking in damp weather, this lawn should be surrounded with a gravel walk, on the outside of which should be borders three or four feet wide for flowers: and from the back of these the prospect will be agreeably terminated by a slope of evergreen shrubs; which, however, should never be suffered to exclude agreeable prospects, or the view of handsome buildings. These walks may lead through the different plantations, gently winding about in an easy natural manner; which will be more agreeable than either those long straight walks, too frequently seen in gardens, or those serpentine windings that are twisted about into so many short turns as to render it difficult to walk in them; and as no garden can be pleasing where there is a want of shade and shelter, these walks should lead as soon as possible into plantations, where persons may walk in private, and be sheltered from the wind.

Narrow rivulets, if they have a constant stream, and are judiciously led about a garden, have a better effect than many of the large stagnating ponds or canals so frequently made in large gardens. When wildernesses are intended, they should not be cut into stars and other ridiculous figures, nor formed into mazes of labyrinths, which in a great design appear trifling.

In short, the several parts of a garden should be diversified; but in places where the eye takes in the whole at once, the two sides should be always the same. In the business of designs, the aim should be always at what is natural, great, and noble. The general disposition of a garden and of its parts ought to be accommodated to the different situations of the ground, to humour its inequalities, to proportion the number and sorts of trees and shrubs to each part, and to shut out from the view of the garden no objects that may become ornamental. But for a more extended view of this subject, see the article GARDENING.

A practical attention to a garden, is by some esteemed a degrading employment. It is true, indeed, that pastoral and agricultural manners, if we may form a judgment from the dignified descriptions of Virgil, are greatly degenerated. The employments of shepherds and husbandmen are now become mean and sordid. The work of the garden is usually left to a peasant. Nor is it unreasonable to assign the labour, which wearies without amusement, to those who are sufficiently amused by the prospect of their wages. But the operations of grafting, of inoculating, of pruning, of transplanting, are curious experiments in natural philosophy; and that they are pleasing as well as curious, those can testify who remember what they felt on seeing their attempts in the amusement of practical gardening attended with success. Among the employments suitable to old age, Cicero has enumerated the superintendence of a garden.

Garden.

It requires no great exertion of mind or body; and its satisfactions are of that kind which please without violent agitation. Its beneficial influence on health is an additional reason for an attention to it at an age when infirmities abound.

In almost every description of the seats of the blessed, ideas of a garden seem to have predominated. The word Paradise itself is synonymous with garden. The fields of Elysium, that sweet region of poesy, are adorned with all that imagination can conceive to be delightful. Some of the most pleasing passages of Milton, are those in which he represents the happy pair engaged in cultivating their blissful abode. Poets have always been delighted with the beauties of a garden. Lucan is represented by Juvenal as reposing in his garden. Virgil's Georgics prove him to have been captivated with rural scenes; though, to the surprise of his readers, he has not assigned a book to the subject of a garden. Our Shenstone made it his study; but, with all his taste and fondness for it, he was not happy in it. The captivating scenes which he created at the Leasowes, afforded him, it is said, little pleasure in the absence of spectators. The truth is, he made the embellishment of his grounds, which should have been the amusement of his life, the business of it; and involved himself in such troubles, by the expences it occasioned, as necessarily excluded tranquil enjoyment.

It is the lot of few, in comparison, to possess territories like his, extensive, and sufficiently well adapted to constitute an ornamented farm. Still fewer are capable of supporting the expence of preserving it in good condition. But let not the rich suppose they have appropriated the pleasures of a garden. The possessor of an acre, or a smaller portion, may receive a real pleasure, from observing the progress of vegetation, even in a plantation of culinary plants. A very limited tract, properly attended to, will furnish ample employment for an individual. Nor let it be thought a mean care; for the same hand that raised the cedar, formed the hyssop on the wall. Even the orchard, cultivated solely for advantage, exhibits beauties unequalled in the shrubbery; nor can the greenhouse produce an appearance to exceed the blossom of the apple and the almond.

Hanging GARDENS, in antiquity, gardens raised on arches by Nebuchadnezzar king of Babylon, in order to gratify his wife Amyctis, daughter of Astyages king of Media. Quintus Curtius makes them equal in height to the walls of the city, viz. 50 feet. They contained a square of 400 feet on every side, and were carried up into the air in several terraces laid above one another, and the ascent from terrace to terrace was by stairs 10 feet wide. The arches sustaining the whole pile were raised above one another, and it was strengthened by a wall, surrounding it on every side, of 22 feet in thickness. The floors of each of the terraces were laid in the following manner: on the top of the arches were first laid large flat stones 16 feet long and 4 broad, and over them was a layer of reeds mixed with a great quantity of bitumen, over which were two rows of bricks closely cemented together by plaster, and over all were laid thick sheets of lead; and lastly, upon the lead was laid the mould of the garden. The mould or earth was of such a depth as to admit the largest trees to take root and grow; and it was covered with various kinds of trees, plants, and flowers. In the upper terrace there was an aqueduct or engine, whereby water was drawn up out of the river for watering the whole garden.

Floating GARDENS. We are informed by the abbé Clavigero in his History of Mexico, that when the Mexicans were brought under subjection to the Colhuan and Tepanecan nations, and confined to the miserable little islands in the lake of Mexico, they ceased for some years to cultivate the land, because they had none, until necessity and industry together taught them to form moveable fields and gardens, which floated on the waters of the lake. The method which they pursued to make these, and which they still practise, is extremely simple. They plait and twist willows and roots of marsh plants or other materials together, which are light, but capable of supporting the earth of the garden firmly united. Upon this foundation they lay the light bushes which float on the lake; and over all, the mud and dirt which they draw up from the bottom of the same lake. Their regular figure is quadrangular; their length and breadth various: but generally they are about eight perches long, and not more than three in breadth, and have less than a foot of elevation above the surface of the water. These were the first fields which the Mexicans owned after the foundation of Mexico; there they first cultivated the maize, great pepper, and other plants necessary for their support. In progress of time, as those fields grew numerous from the industry of the people, there were among them gardens of flowers and odoriferous plants, which were employed in the worship of their gods, and served for the recreation of the nobles. At present they cultivate flowers and every sort of garden herbs upon them. Every day of the year, at sunrise, innumerable vessels loaded with various kinds of flowers and herbs, which are cultivated in those gardens, are seen arriving by the canals, at the great market place of that capital. All plants thrive there surprisingly; the mud of the lake is an extremely fertile soil, and requires no water from the clouds. In the largest gardens there is commonly a little tree, and even a little hut to shelter the cultivator and defend him from rain or the sun. When the owner of a garden, or the *Chinampa* as he is usually called, wishes to change his situation, to remove from a disagreeable neighbour, or to come nearer to his own family, he gets into his little vessel, and by his own strength alone, if the garden is small, or with the assistance of others if it is large, he tows it after him, and conducts it wherever he pleases with the little tree and hut upon it. That part of the lake where those floating gardens are, is a place of infinite recreation, where the senses receive the highest possible gratification.

GARDENING;

GARDENING;

THE art of planning and cultivating gardens. In its utmost extent, whatever contributes to render the scenes of nature delightful, is among the subjects of gardening; and animate as well as inanimate objects are circumstances of beauty or character. The whole range of nature is open to the gardener, from the parterre to the forest; and whatever is agreeable to the senses or the imagination, he may appropriate to the spot he is to improve: it is a part of his business to collect into one place the delights which are generally dispersed through different species of country.

History of Gardening.

GARDENING, Mr Walpole † observes, was probably one of the first arts that succeeded to that of building houses, and naturally attended property and individual possession. Culinary, and afterwards medicinal herbs, were the objects of every head of a family: it became convenient to have them within reach, without seeking them at random in woods, in meadows, and on mountains, as often as they were wanted. When the earth ceased to furnish spontaneously all those primitive luxuries, and culture became requisite, separate enclosures for rearing herbs grew expedient. Fruits were in the same predicament; and those most in use, or that demand attention, must have entered into and extended the domestic enclosure. The good man Noah, we are told, planted a vineyard, drank of the wine, and was drunken; and every body knows the consequences. Thus we acquired kitchen gardens, orchards, and vineyards. No doubt the prototype of all these sorts was the garden of Eden; but as that Paradise was a good deal larger than any we read of afterwards, being enclosed by the rivers Pison, Gihon, Hiddekel, and Euphrates; as every tree that was pleasant to the sight and good for food grew in it; and as two other trees were likewise found there, of which not a slip or sucker remains; it does not belong to the present discussion. After the fall no man living was suffered to enter into the garden; and the poverty and necessities of our first ancestors hardly allowed them time to make improvements in their estates in imitation of it, supposing any plan had been preserved. A cottage and a slip of ground for a cabbage and a gooseberry bush, such as we see by the side of a common, were in all probability the earliest seats and gardens: a well and bucket succeeded to the Pison and Euphrates. As settlements increased, the orchard and the vineyard followed; and the earliest princes of tribes possessed just the necessaries of a modern farmer.

† Hist. of Mod. Gardening, subjoined to the 4th vol. of Anecdotes of Painting.

Matters, we may well believe, remained long in this situation; and we have reason to think that for many centuries the term *garden* implied no more than a kitchen garden or orchard.

The garden of Alcinous, in the Odyssey, is the most renowned in the heroic times. Is there an admirer of Homer who can read his description without rapture? or who does not form to his imagination a scene of delights more picturesque than the landscapes of Tinian or Juan Fernandez? "Yet (continues our author) what was that boasted Paradise with which

> the gods ordain'd
> To grace Alcinous and his happy land?

Why, divested of harmonious Greek and bewitching poetry, it was a small orchard and vineyard, with some beds of herbs and two fountains that watered them, enclosed within a quickset hedge. The whole compass of this pompous garden enclosed—four acres:

> Four acres was th' allotted space of ground,
> Fenc'd with a green enclosure all around.

The trees were apples, figs, pomegranates, pears, olives, and vines.

> Tall thriving trees confess'd the fruitful mold;
> The red'ning apple ripens into gold.
> Here the blue fig with luscious juice o'erflows,
> With deeper red the full pomegranate glows;
> The branch here bends beneath the weighty pear,
> And verdant olives flourish round the year.
> * * * * * *
> Beds of all various herbs, for ever green,
> In beauteous order terminate the scene.

Alcinous's garden was planted by the poet, enriched by him with the fairy gift of eternal summer, and no doubt an effort of imagination surpassing any thing he had ever seen. As he has bestowed on the same happy prince a palace with brazen walls and columns of silver, he certainly intended that the garden should be proportionably magnificent. We are sure, therefore, that, as late as Homer's age, an enclosure of four acres, comprehending orchard, vineyard, and kitchen garden, was a stretch of luxury the world at that time had never beheld."

Previous to this, however, we have in the sacred writings hints of a garden still more luxuriously furnished. We allude to the Song of Solomon, part of the scene of which is undoubtedly laid in a garden *. Flowers and fruits are particularly spoken of as the ornaments and the produce of it; and besides these, aromatic vegetables formed a considerable part of the gratification it afforded. The camphor and the cinnamon tree, with all trees of frankincense, and all the chief spices, flourished there †. Solomon tells us in another place ‡, That he made him great works;—gardens and orchards, and planted in them trees of every kind. Indeed we must suppose his gardens to have been both amply and curiously furnished, seeing the kinds, nature, and properties of the vegetable tribes, seem to have been a favourite study with the royal philosopher, and to have been deemed a subject worthy of his pen: for we are told, that he wrote of plants, from the great cedar of Lebanon down to the hyssop of the wall §. Fountains and streams of water appear also to have had a share in the composition, and probably for ornament as well as use.

* Chap. ii. 1.

† Cant. iv. 12.

‡ Eccl. ii. 4, 5.

§ Kings iv. 33.

The hanging gardens of Babylon, mentioned in a preceding

preceding article, were a still greater prodigy. But as they are supposed to have been formed on terraces and the walls of the palace, whither soil was conveyed on purpose, Mr Walpole concludes, "they were what sumptuous gardens have been in all ages till the present, unnatural, enriched by art, possibly with fountains, statues, balustrades, and summer houses, and were any thing but verdant and rural."

Others, however, have allowed them greater praise. They seem, in many respects, to have been laid out with good taste. Their elevation not only produced a variety and extent of view, but was also useful in moderating the heat. Such a situation would likewise suit a greater variety of trees and plants than a plain surface, and would contain a larger as well as a more diversified extent.

The suiting of the situation to the nature of the tree seems, from the account given by Josephus, to have been one view ‡ in the erecting the building in such a manner. And the success seems to have been answerable, as the trees are said to have flourished extremely well †, and to have grown as tall as in their native situations. On the whole, then, however different these may appear from modern gardens, they seem to have been formed with judgment and taste, and well adapted to the situation and circumstances.

‡ *Contra Apion*, lib. i. § 19.

† *Q. Curt.* lib. v.

It seems probable, from several circumstances, that the eastern gardens were adjoining to the house or palace to which they belonged. Thus, King Ahasuerus goes immediately from the banquet of wine to walk in the garden of the palace §. The garden of Cyrus, at Sardis, mentioned by Xenophon *, was probably contiguous to the palace: as was that of Attalus, mentioned by Justin ‖. The hanging gardens at Babylon, were not so much adjacent to the palace, as a part of the palace itself, since several of the royal apartments were beneath them ‡.

§ Esther vii. 7.

* *Oecon.*

‖ Lib. xxxvi. c. 4.

‡ *Diod.* lib. ii.

It is not clear what the taste for gardening was among the Greeks. The Academus, we know, was a wooded shady place; and the trees appear to have been of the olive species. It was situated beyond the limits of the walls, and adjacent to the tombs of the heroes; and though we are nowhere informed of the particular manner in which this grove was disposed or laid out, it may be gathered from Pausanias, in his Attica, that it was an elegant ornamented place. At the entrance was an altar dedicated to Love, which was said to be the first erected to that deity. Within the Academus, were the altars of Prometheus, of the Muses, of Mercury, of Minerva, and Hercules; and at a small distance was the tomb of Plato. So that in all probability, it was highly adapted by art, as well as nature, to philosophic reflection and contemplation.

We are told by Plutarch, that before the time of Cimon, the Academus was a rude and uncultivated spot: but that it was planted by that general, and had water conveyed to it; whether this water was brought merely for use to refresh the trees, or for ornament, does not appear. It was divided into gymnasia, or places of exercise, and philosophic walks shaded with trees. These are said to have flourished very well, until destroyed by Sylla (when he besieged Athens), as well as those in the Lyceum.

Near the academy were the gardens of the philosophers, of Plato and of Epicurus; which, however, were probably but small. The scene of Plato's Dialogue concerning Beauty is elegantly described as being on the banks of the river Ilissus, and under the shade of the plantain; but no artificial arrangement of objects is mentioned, nor any thing which will lead us to imagine the prospect to be any other than merely natural.

Among the Romans, a taste of gardening, any otherwise than as a matter of utility, seems not to have prevailed till a very late period; at least the writers on husbandry, Cato, Varro, Columella, and Palladius, make not the least mention of a garden as an object of pleasure, but solely with respect to its productions of herbs and fruits. The Lucullan gardens are the first we find mentioned of remarkable magnificence; though probably from the extravagance to which these were arrived, they were not the first. Plutarch speaks of them as incredibly expensive, and equal to the magnificence of kings. They contained artificial elevations of ground to a surprising height, of buildings projected into the sea, and vast pieces of water made upon land. In short, his extravagance and expence were so great, that he acquired thence the appellation of the Roman Xerxes. It is not improbable, from the above account, and from the consideration of Lucullus having spent much time in Asia, in a situation wherein he had an opportunity of observing the most splendid constructions of this kind, that these gardens might be laid out in the Asiatic style. The vast masses of building said to have been erected, might have borne some resemblance, in the arrangement and style, to the Babylonian gardens; and the epithet of the Roman Xerxes might be applicable to the taste, as well as to the size and expence of his works.

The Tusculan villa of Cicero, though often mentioned, is not anywhere described in his works, so as to give an adequate idea of the style in which his gardens or grounds were disposed.

There is but little to be traced in Virgil relative to this subject. Pines †, it seems probable, were a favourite ornament in gardens; and flowers §, roses especially, were much esteemed, perfumes indeed having been always highly valued in warm climates. Virgil places Anchises in Elysium, in a grove of bays: and is careful to remark, that they were of the sweet-scented kind. The Pæstan roses were chiefly valued for their excellent odour; and the same quality appears to be the cause why they were placed by Tibullus as ornaments to the Elysian fields. There appears also to have prevailed among the Romans a piece of luxury relative to gardens, which is equally prevalent at present among us, namely the forcing of flowers at seasons of the year not suited to their natural blowing: and roses were then, as at present, the principal flowers upon which these experiments were tried, as appears from Martial ‡ and others.

† *Ecl*[og.] ii. 65. & § *Geo*[rg.] i[v.] 118.

When Roman authors (Mr Walpole remarks), whose climate instilled a wish for cool retreats, speak of their enjoyments in that kind, they sigh for grottoes, caves, and the refreshing hollows of mountains, near irriguous and shady founts; or boast of their porticoes, walks of planes, canals, baths, and breezes from the sea. Their gardens are never mentioned as affording shade and shelter from the rage of the dog star. Pliny has left us descriptions of two of his villas. As he used his Laurentine villa for his winter retreat, it is not surprising

‡ *Vi*[de] *Epi*[g.] vi. e[t] lib. 127. *Lam*[pri]*dius* *Eleg*[ab.]

surprising that the garden makes no considerable part of the account. All he says of it is, that the gestatio or place of exercise, which surrounded the garden (the latter consequently not being very large), was bounded by a hedge of box, and, where that was perished, with rosemary; that there was a walk of vines; and that most of the trees were fig and mulberry, the soil not being proper for any other sorts. On his Tuscan villa he is more diffuse; the garden makes a considerable part of the description:—and what was the principal beauty of that pleasure ground? Exactly what was the admiration of this country about threescore years ago; box trees cut into monsters, animals, letters, and the names of the master and the artifice. In an age when architecture displayed all its grandeur, all its purity, and all its taste; when arose Vespasian's amphitheatre, the temple of Peace, Trajan's forum, Domitian's baths, and Adrian's villa, the ruins and vestiges of which still excite our astonishment and curiosity; a Roman consul, a polished emperor's friend, and a man of elegant literature and taste, delighted in what the mob now scarce admire in a college garden. All the ingredients of Pliny's corresponded exactly with those laid out by London and Wise on Dutch principles. He talks of slopes, terraces, a wilderness, shrubs methodically trimmed, a marble bason, pipes spouting water, a cascade falling into the bason, bay trees alternately planted with planes, and a straight walk from whence issued others parted off by hedges of box and apple trees, with obelisks placed between every two. There wants nothing but the embroidery of a parterre, to make a garden in the time of Trajan serve for a description of one in that of King William. In one passage above, Pliny seems to have conceived that natural irregularity might be a beauty; *in opere urbanissimo*, says he, *subita velut illati ruris imitatio*. Something like a rural view was contrived amidst so much polished composition. But the idea soon vanished, lineal walks immediately enveloped the slight scene, and names and inscriptions in box again succeeded to compensate for the daring introduction of nature.

In the paintings found at Herculaneum are a few traces of gardens, as may be seen in the second volume of the prints. They are small square enclosures, formed by trellis-work and espaliers, and regularly ornamented with vases, fountains, and careatides, elegantly symmetrical, and proper for the narrow spaces allotted to the garden of a house in a capital city.

From what has been said, it appears how naturally and insensibly the idea of a kitchen garden slid into that which has for so many ages been peculiarly termed a *garden*, and by our ancestors in this country distinguished by the name of a *pleasure garden*. A square piece of ground was originally parted off in early ages for the use of the family:—to exclude cattle, and ascertain the property, it was separated from the fields by a hedge. As pride and desire of privacy increased, the enclosure was dignified by walls; and in climes where fruits were not lavished by the ripening glow of nature and soil, fruit trees were assisted and sheltered from surrounding winds by the like expedient: for the inundation of luxuries, which have swelled into general necessities, have almost all taken their source from the simple fountain of reason.

When the custom of making square gardens enclosed with walls was thus established to the exclusion of nature and prospect, pomp and solitude combined to call for something that might enrich and enliven the insipid and unanimated partition. Fountains, first invented for use, which grandeur loves to disguise and throw out of the question, received embellishments from costly marbles, and at last, to contradict utility, tossed their waste of waters into the air in spouting columns. Art, in the hands of rude man, had at first been made a succedaneum to nature; in the hands of ostentatious wealth, it became the means of opposing nature; and the more it traversed the march of the latter, the more nobility thought its power was demonstrated. Canals measured by the line were introduced in lieu of meandering streams, and terraces were hoisted aloft in opposition to the facile slopes that imperceptibly unite the valley to the hill. Balustrades defended these precipitate and dangerous elevations, and flights of steps rejoined them to the subjacent flat from which the terrace had been dug. Vases and sculpture were added to these unnecessary balconies, and statues furnished the lifeless spot with mimic representations of the excluded sons of men. Thus difficulty and expence were the constituent parts of those sumptuous and selfish solitudes; and every improvement that was made, was but a step farther from nature. The tricks of waterworks to wet the unwary, not to refresh the panting spectator; and parterres embroidered in patterns like a petticoat, were but the childish endeavours of fashion and novelty to reconcile greatness to what it had surfeited on. To crown these impotent displays of false taste, the sheers were applied to the lovely wildness of form with which nature has distinguished each various species of tree and shrub. The venerable oak, the romantic beech, the useful elm, even the aspiring circuit of the lime, the regular round of the chesnut, and the almost moulded orange tree, were corrected by such fantastic admirers of symmetry. The compass and square were of more use in plantations than the nurseryman. The measured walk, the quincunx, and the etoile, imposed their unsatisfying sameness on every royal and noble garden. Trees were headed, and their sides pared away; many French groves seem green chests set upon poles. Seats of marble, arbours, and summer houses, terminate every vista; and symmetry, even where the space was too large to permit its being remarked at one view, was so essential that, as Pope observed,

> ——— each alley has a brother,
> And half the garden just reflects the other.

Knots of flowers were more defensibly subjected to the same regularity. Leisure, as Milton expressed it,

> —— in trim gardens took his pleasure.

In the garden of Marshal de Biron at Paris, consisting of 14 acres, every walk is buttoned on each side by lines of flower pots, which succeed in their seasons.

It does not precisely appear what our ancestors meant by a bower: it was probably an arbour; sometimes it meant the whole frittered enclosure, and in one instance it certainly included a labyrinth. Rosamond's bower was indisputably of that kind; though whether composed of walls or hedges, we cannot determine. A square and a round labyrinth were so capital ingredients of of a garden formerly, that in Du Cercean's architecture, who lived in the time of Charles IX. and Henry III. there is scarce a ground plot without one of each.

In Kip's Views of the Seats of our Nobility and Gentry, we see the same tiresome and returning uniformity. Every house is approached by two or three gardens, consisting perhaps of a gravel walk and two grass plats or borders of flowers. Each rises above the other by two or three steps, and as many walls and terraces, and so many iron gates, that we recollect those ancient romances in which every entrance was guarded by nymphs or dragons. Yet though these and such preposterous inconveniences prevailed from age to age, good sense in this country had perceived the want of something at once more grand and more natural. These reflections, and the bounds set to the waste made by royal spoilers, gave origin to Parks. They were contracted forests, and extended gardens. Hentzner says, that, according to Rous of Warwick, the first park was that at Woodstock. If so, it might be the foundation of a legend that Henry II. secured his mistress in a labyrinth: it was no doubt more difficult to find her in a park than in a palace, where the intricacy of the woods and various lodges buried in covert might conceal her actual habitation.

It is more extraordinary that, having so long ago stumbled on the principle of modern gardening, we should have persisted in retaining its reverse, symmetrical and unnatural gardens. That parks were rare in other countries, Hentzner, who travelled over great part of Europe, leads us to suppose, by observing that they were common in England. In France they retain the name, but nothing is more different both in compass and disposition. Their parks are usually square or oblong enclosures, regularly planted with walks of chesnuts or limes, and generally every large town has one for its public recreation.

"One man, one great man, we had (continues Mr Walpole), on whom nor education nor custom could impose their prejudices; who, 'on evil days though fallen, and with darkness and solitude compassed round,' judged that the mistaken and fantastic ornaments he had seen in gardens, were unworthy of the Almighty hand that planted the delights of Paradise. He seems with the prophetic eye of taste to have conceived, to have foreseen modern gardening; as Lord Bacon announced the discoveries since made by experimental philosophy. The description of Eden is a warmer and more just picture of the present style than Claud Lorraine could have painted from Hagley or Stourhead. The first lines we shall quote exhibit Stourhead on a more magnificent scale:

> Thro' Eden went a river large,
> Nor chang'd his course, but thro' the shaggy hill,
> Pass'd underneath ingulphed: for God had thrown
> That mountain as his garden mound, high rais'd
> Upon the rapid current——

Hagley seems pictured in what follows:

> Which thro' veins
> Of porous earth with kindly thirst updrawn,
> Rose a fresh fountain, and with many a rill
> Watered the garden——

What colouring, what freedom of pencil, what landscape in these lines!

> ——from that sapphire fount the crisped brooks,
> Rolling on orient pearl and sands of gold,
> With mazy error under pendant shades,
> Ran nectar, visiting each plant, and fed
> Flow'rs worthy of Paradise, which not *nice art*
> In beds and curious knots, but *nature boon*,
> Pour'd forth profuse on hill, and dale, and plain,
> Both where the morning sun first warmly smote
> The *open field*, and where the unpierc'd shade
> Imbrown'd the noontide bow'rs—*Thus was this place*
> *A happy rural seat of various view.*

Read this transporting description, paint to your mind the scenes that follow, contrast them with the savage but respectable terror with which the poet guards the bounds of his paradise, fenced

> ——with the champaign head
> Of a steep wilderness, whose hairy sides
> With thicket overgrown, grotesque and wild,
> Access denied; and over head up grew
> Insuperable height of loftiest shade,
> Cedar and pine, and fir, and branching palm,
> A sylvan scene, and, as the ranks ascend,
> Shade above shade, a woody theatre,
> Of stateliest view——

and then recollect, that the author of this sublime vision had never seen a glimpse of any thing like what he has imagined; that his favourite ancients had dropped not a hint of such divine scenery; and that the conceits in Italian gardens, and Theobalds and Nonsuch, were the brightest originals that his memory could furnish. His intellectual eye saw a nobler plan, so little did he suffer by the loss of sight. It sufficed him to have seen the materials with which he could work. The vigour of a boundless imagination told him how a plan might be disposed, that would embellish nature, and restore art to its proper office, the just improvement or imitation of it.

"Now let us return to an admired writer, posterior to Milton, and see how cold, how insipid, how tasteless, is his account of what he pronounced a perfect garden. We speak not of his style, which it was not necessary for him to animate with the colouring and glow of poetry. It is his want of ideas, of imagination, of taste, that deserve censure, when he dictated on a subject which is capable of all the graces that a knowledge of beautiful nature can bestow. Sir William Temple was an excellent man; Milton, a genius of the first order.

"We cannot wonder that Sir William declares in favour of parterres, fountains, and statues, as necessary to break the sameness of large grass plots, which he thinks have an ill effect upon the eye, when he acknowledges that he discovers fancy in the gardens of Alcinous. Milton studied the ancients with equal enthusiasm, but no bigotry; and had judgment to distinguish between the want of invention and the beauties of poetry. Compare his paradise with Homer's garden, both ascribed to a celestial design. For Sir William, it is just to observe, that his ideas centered in a fruit garden. He had the honour of giving to his country many delicate fruits,

fruits, and he thought of little else than disposing them to the best advantage.

"The best figure of a garden (says he) is either a square or an oblong, and either upon a flat or a descent: they have all their beauties, but the best I esteem an oblong upon a descent. The beauty, the air, the view, make amends for the expence, which is very great in finishing and supporting the terrace walks, in levelling the parterres, and in the stone stairs that are necessary from one to the other. The perfectest figure of a garden I ever saw, either at home or abroad, was that of Moor Park in Hertfordshire, when I knew it about 30 years ago. It was made by the countess of Bedford, esteemed among the greatest wits of her time, and celebrated by Dr Donne; and with very great care, excellent contrivance, and much cost; but greater sums may be thrown away without effect or honour, if there want sense in proportion to money, or 'if nature be not followed;' which I take to be the great rule in this, and perhaps in every thing else, as far as the conduct not only of our lives but our governments.' [We shall see how natural that admired garden was]. 'Because I take the garden I have named to have been in all kinds the most beautiful and perfect, at least in the figure and disposition, that I ever have seen, I will describe it for a model to those that meet with such a situation, and are above the regards of common expence. It lies on the side of a hill, upon which the house stands, but not very steep. The length of the house, where the best rooms and of most use or pleasure are, lies upon the breadth of the garden; the great parlour opens into the middle of a terrace gravel walk that lies even with it, and which may be, as I remember, about 300 paces long, and broad in proportion; the border set with standard laurels and at large distances, which have the beauty of orange trees out of flower and fruit. From this walk are three descents by many stone steps, in the middle and at each end, into a very large parterre. This is divided into quarters by gravel walks, and adorned with two fountains and eight statues in the several quarters. At the end of the terrace walk are two summer houses, and the sides of the parterre are ranged with two large cloisters open to the garden, upon arches of stone, and ending with two other summer houses even with the cloisters, which are paved with stone, and designed for walks of shade, there being none other in the whole parterre. Over these two cloisters are two terraces covered with lead and fenced with balusters; and the passage into these airy walks is out of the two summer houses at the end of the first terrace walk. The cloister facing the south is covered with vines, and would have been proper for an orange house, and the other for myrtles or other more common greens, and had, I doubt not, been cast for that purpose, if this piece of gardening had been then in as much vogue as it is now. From the middle of this parterre is a descent by many steps flying on each side of a grotto, that lies between them, covered with lead and flat, into the lower garden, which is all fruit trees ranged about the several quarters of a wilderness, which is very shady; the walks here are all green, the grotto embellished with figures of shell rock-work, fountains, and water works. If the hill had not ended with the lower garden, and the wall were not bounded by a common way that goes through the park, they might have added a third quarter of all greens; but this want is supplied by a garden on the other side the house, which is all of that sort, very wild, shady, and adorned with rough rock-work and fountains. This was Moor Park when I was acquainted with it, and the sweetest place, I think, that I have seen in my life, either before or since, at home or abroad.'

"It is unnecessary to add any remarks on this description. Any man might design and build as sweet a garden, who had been born in and never stirred out of Holborn. It was not, however, peculiar to Sir William Temple to think in that manner. How many Frenchmen are there who have seen our gardens, and still prefer natural flights of steps and shady cloisters covered with lead! Le Nautre, the architect of the groves and grottoes at Versailles, came hither on a mission to improve our taste. He planted St James's and Greenwich Parks—no great monuments of his invention.

"To do farther justice to Sir William Temple, we must not omit what he adds. 'What I have said of the best forms of gardens is meant only of such as are in some sort regular; for there may be other forms wholly irregular, that may, for ought I know, have more beauty than any of the others: but they must owe it to some extraordinary dispositions of nature in the seat, or some great race of fancy or judgment in the contrivance, which may reduce many disagreeing parts into some figure, which shall yet, upon the whole, be very agreeable. Something of this I have seen in some places, but heard more of it from others who have lived much among the Chineses, a people whose way of thinking seems to lie as wide of ours in Europe as their country does. Their greatest reach of imagination is employed in contriving figures, where the beauty shall be great and strike the eye, but without any order or disposition of parts, that shall be commonly or easily observed. And though we have hardly any notion of this sort of beauty, yet they have a particular word to express it: and when they find it hit their eye at first sight, they say the Sharawadgi is fine or is admirable, or any such expression of esteem: but I should hardly advise any of these attempts in the figure of gardens among us; they are adventures of too hard achievement for any common hands; and though there may be more honour if they succeed well, yet there is more dishonour if they fail, and it is twenty to one they will; whereas in regular figures it is hard to make any great and remarkable faults.'

"Fortunately Kent and a few others were not quite so timid, or we might still be going up and down stairs in the open air. It is true, we have heard much lately, as Sir William Temple did, of irregularity and imitations of nature in the gardens or grounds of the Chinese. The former is certainly true: they are as whimsically irregular, as European gardens are formally uniform and unvaried:—but with regard to nature, it seems as much avoided, as in the squares and oblongs and straight lines of our ancestors. An artificial perpendicular rock starting out of a flat plain, and connected with nothing, often pierced through in various places with oval hollows, has no more pretension to be deemed natural than a lineal terrace or a parterre. The late Mr Joseph Spence, who had both taste and zeal for

for the present style, was so persuaded of the Chinese emperor's pleasure ground being laid out on principles resembling ours, that he translated and published, under the name of Sir Harry Beaumont, a particular account of that enclosure, from the collection of the letters of the Jesuits. But except a determined irregularity, one can find nothing in it that gives any idea of attention being paid to nature. It is of vast circumference, and contains 200 palaces, besides as many contiguous for the eunuchs, all gilt, painted, and varnished. There are raised hills from 20 to 60 feet high, streams and lakes, and one of the latter five miles round. These waters are passed by bridges:—but even their bridges must not be straight—they serpentize as much as the rivulets, and are sometimes so long as to be furnished with resting places, and begin and end with triumphal arches. The colonnades undulate in the same manner. In short, this pretty gaudy scene is the work of caprice and whim, and, when we reflect on their buildings, presents no image but that of unsubstantial tawdriness. Nor is this all. Within this fantastic paradise is a square town, each side a mile long. Here the eunuchs of the court, to entertain his imperial majesty with the bustle and business of the capital in which he resides, but which it is not of his dignity ever to see, act merchants and all sorts of trades, and even designedly exercise for his royal amusement every art of knavery that is practised under his auspicious government. Methinks this is the childish solace and repose of grandeur, not a retirement from affairs to the delights of rural life. Here too his majesty plays at agriculture: there is a quarter set apart for that purpose; the eunuchs sow, reap and carry in their harvest, in the imperial presence; and his majesty returns to Pekin, persuaded that he has been in the country.

"Having thus cleared our way by ascertaining what have been the ideas on gardening in all ages as far as we have materials to judge by, it remains to show to what degree Mr Kent invented the new style, and what hints he had received to suggest and conduct his undertaking.

"We have seen what Moor Park was, when pronounced a standard. But as no succeeding generation in an opulent and luxurious country contents itself with the perfection established by its ancestors, more perfect perfection was still sought; and improvements had gone on, till London and Wise had stocked all our gardens with giants, animals, monsters, coats of arms, and mottoes, in yew, box, and holly. Absurdity could go no farther, and the tide turned. Bridgman, the next fashionable designer of gardens, was far more chaste; and whether from good sense, or that the nation had been struck and reformed by the admirable paper in the Guardian, N° 173. he banished verdant sculpture, and did not even revert to the square precision of the foregoing age. He enlarged his plans, disdained to make every division tally to its opposite; and though he still adhered much to straight walks with high clipped hedges, they were only his great lines; the rest he diversified by wilderness, and with loose groves of oak, though still within surrounding hedges. As his reformation gained footing, he ventured, in the royal garden at Richmond, to introduce cultivated fields, and even morsels of a forest appearance, by the sides of those endless and tiresome walks that stretched out of one into another without intermission. But this was not till other innovators had broke loose too from rigid symmetry.

"But the capital stroke, the leading step to all that has followed, was the destruction of walls for boundaries, and the invention of fosses—an attempt then deemed so astonishing, that the common people called them Ha! Ha's! to express their surprise at finding a sudden and unperceived check to their walk.

"A sunk fence may be called the *leading step*, for these reasons. No sooner was this simple enchantment made, than levelling, mowing, and rolling, followed. The contiguous ground of the park without the sunk fence was to be harmonized with the lawn within; and the garden in its turn was to be set free from its prime regularity, that it might assort with the wilder country without. The sunk fence ascertained the specific garden; but that it might not draw too obvious a line of distinction between the neat and the rude, the contiguous out-lying parts came to be included in a kind of general design; and when nature was taken into the plan, under improvements, every step that was made pointed out new beauties, and inspired new ideas. At that moment appeared Kent, painter enough to taste the charms of landscape, bold, and opinionative enough to dare and to dictate, and born with a genius to strike out a great system from the twilight of imperfect essays. He leaped the fence, and saw that all nature was a garden. He felt the delicious contrast of hill and valley changing imperceptibly into each other, tasted the beauty of the gentle swell or concave scoop, and remarked how loose grooves crowned an easy eminence with happy ornament; and while they called in the distant view between their graceful stems, removed and extended the perspective by delusive comparison.

"Thus the pencil of his imagination bestowed all the arts of landscape on the scenes he handled. The great principles on which he worked were perspective, and light and shade. Groups of trees broke too uniform or too extensive a lawn; evergreens and woods were opposed to the glare of the champaign; and where the view was less fortunate, or so much exposed as to be beheld at once, he blotted out some parts by thick shades, to divide it into variety, or to make the richest scene more enchanting by reserving it to a farther advance of the spectator's step. Thus, selecting favourite objects, and veiling deformities by screens of plantation; sometimes allowing the rudest waste to add its foil to the richest theatre; he realized the compositions of the greatest masters in painting. Where objects were wanting to animate his horizon, his taste as an architect could bestow immediate termination. His buildings, his seats, his temples, were more the works of his pencil than of his compasses. We owe the restoration of Greece and the diffusion of architecture to his skill in landscape.

"But of all the beauties he added to the face of this beautiful country, none surpassed his management of water. Adieu to canals, circular basons and cascades tumbling down marble steps, that last absurd magnificence of Italian and French villas. The forced elevation of cataracts was no more. The gentle stream was taught to serpentize seemingly at its pleasure; and where

where discontinued by different levels, its course appeared to be concealed by thickets properly interspersed, and glittered again at a distance, where it might be supposed naturally to arrive. Its borders were smoothed, but preserved their waving irregularity. A few trees scattered here and there on its edges sprinkled the tame bank that accompanied its meanders; and when it disappeared among the hills, shades descending from the heights leaned towards its progress, and framed the distant point of light under which it was lost, as it turned aside to either hand of the blue horizon.

"Thus, dealing in none but the colours of nature, and catching its most favourable features, men saw a new creation opening before their eyes. The living landscape was chastened or polished, not transformed. Freedom was given to the forms of trees: they extended their branches unrestricted; and where any eminent oak, or master beech, had escaped maiming and survived the forest, bush and bramble was removed, and all its honours were restored to distinguish and shade the plain. Where the united plumage of an ancient wood extended wide its undulating canopy, and stood venerable in its darkness, Kent thinned the foremost ranks, and left but so many detached and scattered trees, as softened the approach of gloom, and blended a chequered light with the thus lengthened shadows of the remaining columns.

"Succeeding artists have added new master strokes to these touches; perhaps improved or brought to perfection some that have been named. The introduction of foreign trees and plants, which we owe principally to Archibald duke of Argyle, contributed essentially to the richness of colouring so peculiar to our modern landscape. The mixture of various greens, the contrast of forms between our forest trees and the northern and West Indian firs and pines, are improvements more recent than Kent, or but little known to him. The weeping willow, and every florid shrub, each tree of delicate or bold leaf, are new tints in the composition of our gardens.

"But just as the encomiums are that have been bestowed on Kent's discoveries, he was neither without assistance or faults. Mr Pope undoubtedly contributed to form his taste. The design of the prince of Wales's garden at Carlton house was evidently borrowed from the poet's at Twickenham. There was a little of affected modesty in the latter, when he said, of all his works he was most proud of his garden. And yet it was a singular effort of art and taste to impress so much variety and scenery on a spot of five acres. The passing through the gloom from the grotto to the opening day, the retiring and again assembling shades, the dusky groves, the larger lawn, and the solemnity of the termination at the cypresses that lead up to his mother's tomb, are managed with exquisite judgment; and though Lord Peterborough assisted him

> To form his quincunx and to rank his vines,

those were not the most pleasing ingredients of his little perspective.

"Having routed professed art (for the modern gardener exerts his talents to conceal his art), Kent, like other reformers, knew not how to stop at the just limits. He had followed Nature, and imitated her so happily, that he began to think all her works were equally proper for imitation. In Kensington garden he planted dead trees to give a greater air of truth to the scene—but he was soon laughed out of this excess. His ruling principle was, that nature abhors a straight line. His mimics (for every genius has his apes), seemed to think that she could love nothing but what was crooked. Yet so many men of taste of all ranks devoted themselves to the new improvements, that it is surprising how much beauty has been struck out, with how few absurdities. Still in some lights the reformation seems to have been pushed too far. Though an avenue crossing a park or separating a lawn, and intercepting views from the seat to which it leads, are capital faults; yet a great avenue cut through woods, perhaps before entering a park, has a noble air, and,

> Like footmen running before coaches
> To tell the inn what lord approaches,

announces the habitation of some man of distinction. In other places the total banishment of all particular neatness immediately about a house, which is frequently left gazing by itself in the middle of a park, is a defect. Sheltered and even close walks, in so very uncertain a climate as ours, are comforts ill exchanged for the few picturesque days that we enjoy; and whenever a family can purloin a warm and even something of an old-fashioned garden from the landscape designed for them by the undertaker in fashion, without interfering with the picture, they will find satisfactions in those days that do not invite strangers to come and see their improvements."

PART I. PRINCIPLES OF GARDENING.

GARDENING, in the perfection to which it has been lately brought in Britain, is entitled to a place of considerable rank among the liberal arts. It is (says Ms Wheatley) as superior to landscape painting as a reality to a representation: it is an exertion of fancy; a subject for taste; and being released now from the restraints of regularity, and enlarged beyond the purposes of domestic convenience, the most beautiful, the most simple, the most noble scenes of nature, are all within its province. For it is no longer confined to the spots from which it takes its name; but as already observed, regulates also the disposition and embellishment of a park, a farm, a forest, &c.: and the business of a gardener is to select and apply whatever is great, elegant, or characteristic in any of them; to discover, and to show all the advantages of the place upon which he is employed; to supply its defects, to correct its faults, and to improve its beauties.

Ground, Wood.

Sect. I. *Materials of Gardening.*

These may be divided into two general classes; *Natural* and *Factitious.*

§ 1. *Of the* Natural Materials.

These, according to Mr Wheatley's enumeration, are—Ground, Wood, Water, and Rocks.

I. GROUND. By this is meant that portion of naked surface which is included within the place to be improved; whether that surface be swamp, lawn, roughet, or broken ground; and whether it be a height, a valley, a plain, or a composition of swells, dips, and levels.

The following passage has been quoted from Mr Gilpin's observations on the Wye*, as affording a sublime idea of what ground ought to be.—"Nothing (says he) gives so just an idea of the beautiful swellings of ground as those of water, where it has sufficient room to undulate and expand. In ground which is composed of very refractory materials, you are presented often with harsh lines, angular insertions, and disagreeable abruptnesses. In water, whether in gentle or in agitated motion, all is easy, all is softened into itself; and the hills and valleys play into each other in a variety of the most beautiful forms. In agitated water, abruptnesses indeed there are, but yet they are such abruptnesses as in some part or other unite properly with the surface around them; and are on the whole peculiarly harmonious. Now, if the ocean in any of these swellings and agitations could be arrested and fixed, it would produce that pleasing variety which we admire in ground. Hence it is common to fetch our images from water, and apply them to land: we talk of an undulating line, a playing lawn, and a billowy surface; and give a much stronger and more adequate idea by such imagery, than plain language could possibly present."

* Page 62.

The exertions of art, however, are here inadequate; and the artist ought not to attempt to create a mountain, a valley, or a plain: he should but rarely meddle even with the smaller inequalities of grounds. Roughets and broken ground may generally be reduced to lawn, or hid with wood; and a swamp may be drained or covered with water; whilst lawn may be variegated at pleasure by wood, and sometimes by water.

II. WOOD, as a general term, comprehends all trees and shrubs in whatever disposition; but it is specifically applied in a more limited sense, and in that sense we shall now use it.

Every plantation must be either a *wood*, a *grove*, or *clump*. A wood is composed both of trees and underwood, covering a considerable space. A grove consists of trees without underwood. A clump differs from either only in extent: it may be either close or open; when close, it is sometimes called a *thicket*; when open, a *group of trees*; but both are equally clumps, whatever may be the shape or situation.

1 Of the surface of a wood.

1. One of the noblest objects in nature (Mr Wheatley observes) is the *surface of a large thick wood*, commanded from an eminence, or seen from below hanging on the side of a hill. The latter is generally the more interesting object. Its aspiring situation gives it an air of greatness; its termination is commonly the horizon; and, indeed, if it is deprived of that splendid boundary, if the brow appears above it (unless some very peculiar effect characterises that brow), it loses much of its magnificence: it is inferior to a wood which covers a less hill from the top to the bottom; for a whole space filled is seldom little. But a wood commanded from an eminence is generally no more than a part of the scene below; and its boundary is often inadequate to its greatness. To continue it, therefore, till it winds out of sight, or loses itself in the horizon, is generally desirable: but then the varieties of its surface grow confused as it retires; while those of a hanging wood are all distinct, the furthest parts are held up to the eye, and none are at a distance though the whole be extensive.

The varieties of a surface are essential to the beauty of it: a continued smooth shaven level of foliage is neither agreeable nor natural; the different growths of trees commonly break it in reality, and their shadows still more in appearance. These shades are so many tints, which, undulating about the surface, are its greatest embellishment; and such tints may be produced with more effect, and more certainty, by a judicious mixture of greens; at the same time an additional variety may be introduced, by grouping and contrasting trees very different in shape from each other; and whether variety in the greens or in the forms be the design, the execution is often easy, and seldom to a certain degree impossible. In raising a young wood, it may be perfect. In old woods, there are many spots which may be either thinned or thickened: and there the characteristic distinctions should determine what to plant, or which to leave; at the least will often point out those which, as blemishes, ought to be taken away; and the removal of two or three trees will sometimes accomplish the design. The number of beautiful forms and agreeable masses, which may decorate the surface, is so great, that where the place will not admit of one, another is always ready; and as no delicacy of finishing is required, no minute exactness is worth regarding; great effects will not be disconcerted by small obstructions and little disappointments.

The contrasts, however, of masses and of groups must not be too strong, where *greatness* is the character of the wood; for unity is essential to greatness: and if direct opposites be placed close together, the wood is no longer one object; it is only a confused collection of several separate plantations. But if the progress be gradual from the one to the other, shapes and tints widely different may assemble on the same surface; and each should occupy a considerable space: a single tree, or a small cluster of trees, in the midst of an extensive wood, is in size but a speck, and in colour but a spot; the groups and the masses must be large to produce any sensible variety.

When, in a romantic situation, very broken ground is overspread with wood, it may be proper on the surface of the wood to mark the inequalities of the ground. *Rudeness*, not greatness, is the prevailing idea; and a choice directly the reverse of that which is productive of unity will produce it. Strong contrasts, even oppositions,

sitions, may be eligible; the aim is rather to disjoin than to connect: a deep hollow may sink into dark greens; an abrupt bank may be shewn by a rising stage of aspiring trees, a sharp ridge by a narrow line of conical shapes: firs are of great use upon such occasions; their tint, their form, their singularity, recommend them.

A hanging *wood of thin forest trees*, and seen from below is seldom pleasing: these few trees are by the perspective brought nearer together; it loses the beauty of a thin wood, and is defective as a thick one: the most obvious improvement, therefore is to thicken it. But, when seen from an eminence, a thin wood is often a lively and elegant circumstance in a view; it is full of objects; and every separate tree shows its beauty. To increase that vivacity which is the peculiar excellence of a thin wood, the trees should be characteristically distinguished both in their tints and their shapes; and such as for their airiness have been proscribed in a thick wood, are frequently the most eligible here. Differences also in their growths are a farther source of variety; each should be considered as a distinct object, unless where a small number are grouped together; and then all that compose the little cluster must agree: but the groups themselves, for the same reason as the separate trees, should be strongly contrasted; the continued underwood is their only connexion, and that is not affected by their variety.

Of the outline of a wood.

Though the surface of a wood, when commanded, deserves all these attentions, yet the *outline* more frequently calls for our regard: it is also more in our power; it may sometimes be great, and may always be beautiful. The first requisite is irregularity. That a mixture of trees and underwood should form a long straight line, can never be natural; and a succession of easy sweeps and gentle rounds, each a portion of a greater or less circle, composing all together a line literally serpentine, is, if possible, worse. It is but a number of regularities put together in a disorderly manner, and equally distant from the beautiful both of art and of nature. The true beauty of an outline consists more in breaks than in sweeps; rather in angles than in rounds; in variety, not in succession.

Every variety in the outline of a wood must be a *prominence* or a *recess*. Breadth in either is not so important as length to the one and depth to the other. If the former ends in an angle, the latter diminishes to a point; they have more force than a shallow dent, or a dwarf excrescence, how wide so ever. They are greater deviations from the continued line which they are intended to break; and their effect is to enlarge the wood itself, which seems to stretch from the most advanced point, back beyond the most distant to which it retires. The extent of a large wood on a flat, not commanded, can by no circumstance be so manifestly shewn as by a deep recess; especially if that recess wind so as to conceal the extremity, and leave the imagination to pursue it. On the other hand, the poverty of a shallow wood might sometimes be relieved by here and there a prominence, or clumps which by their apparent junction should seem to be prominences from it. A deeper wood with a continued outline, except when commanded, would not appear so considerable.

An inlet into a wood seems to have been cut, if the opposite points of the entrance tally; and that show of art depreciates its merit: but a difference only in the situation of those points, by bringing one more forward than the other, prevents the appearance, though their forms be similar. Other points, which distinguish the great parts, should in general be strongly marked: a short turn has more spirit in it than a tedious circuity; and a line broken by angles has a precision and firmness, which in an undulated line are wanting; the angles should indeed commonly be a little softened; the rotundity of the plant which forms them is sometimes sufficient for the purpose; but if they are mellowed down too much, they lose all meaning. Three or four large parts thus boldly distinguished, will break a very long outline. When two woods are opposed on the sides of a narrow glade, neither has so much occasion for variety in itself as if it were single; if they are very different from each other, the contrast supplies the deficiency to each, and the interval between them is full of variety. The form of that interval is indeed of as much consequence as their own: though the outlines of both the woods be separately beautiful, yet if together they do not cast the open space into an agreeable figure, the whole scene is not pleasing; and a figure is never agreeable, when the sides too closely correspond: whether they are exactly the same, or exactly the reverse of each other, they equally appear artificial.

Wood. Wheatley's Observat. on Modern Gardening.

Every variety of outline hitherto mentioned may be traced by the underwood alone; but frequently the same effects may be produced with more ease, and with much more beauty, by a few trees standing out from the thicket, and belonging, or seeming to belong, to the wood, so as to make a part of its figure. Even where they are not wanted for that purpose, detached trees are such agreeable objects, so distinct, so light, when compared to the covert about them, that skirting along it in some parts, and breaking it in others, they give an unaffected grace, which can no otherwise be given to the outline. They have a still further effect, when they stretch across the whole breadth of an inlet, or before part of a recess into the wood; they are themselves shown to advantage by the space behind them; and that space, seen between their stems, they in return throw into an agreeable perspective.

2. The prevailing character of a wood is generally grandeur: the principal attention therefore which it requires, is to prevent the excesses of that character, to diversify the uniformity of its extent, to lighten the unwieldiness of its bulk, and to blend graces with greatness. The character of a *grove* is beauty. Fine trees are lovely objects: a grove is an assemblage of them; in which every individual retains much of its own peculiar elegance, and whatever it loses is transferred to the superior beauty of the whole. To a grove, therefore, which admits of endless variety in the disposition of the trees, differences in their shapes and their greens are seldom very important, and sometimes they are detrimental. Strong contracts scatter trees which are thinly planted, and which have not the connection of underwood; they no longer form one plantation; they are a number of single trees. A thick grove is not indeed exposed to this mischief, and certain situations may recommend different shapes and different greens for their effects upon the surface; but in the outline they are seldom much regarded. The eye attracted into the depth of

3 Of a grove.

Wood. ibid.

of the grove, passes by little circumstances at the entrance; even varieties in the form of the line do not always engage the attention; they are not so apparent as in a continued thicket, and are scarcely seen if they are not considerable.

But the surface and the outline are not the only circumstances to be attended to. Though a grove be beautiful as an object, it is besides delightful as a spot to walk or to sit in; and the choice and the disposition of the trees for effects within, are therefore a principal consideration. Mere irregularity alone will not please: strict order is there more agreeable than absolute confusion; and some meaning better than none. A regular plantation has a degree of beauty; but it gives no satisfaction, because we know that the same number of trees might be more beautifully arranged. A disposition, however, in which the lines only are broken, without varying the distances, is equally improper. The trees should gather into groups, or stand in various irregular lines, and describe various figures: the intervals between them should be contrasted both in shape and in dimensions: a large space should in some places be quite open; in others the trees should be so close together, as hardly to leave a passage between them; and in others as far apart as the connexion will allow. In the forms and the varieties of these groups, these lines, and these openings, principally consists the interior beauty of a grove.

The force of them is most strongly illustrated at Claremont †, where the walk to the cottage, though destitute of many natural advantages, and eminent for none; though it commands no prospect; though the water below it is a trifling pond; though it has nothing, in short, but inequality of ground to recommend it; is yet the finest part of the garden: for a grove is there planted in a gently curved direction, all along the side of a hill, and on the edge of a wood, which rises above it. Large recesses break it into several clumps, which hang down the declivity: some of them approaching, but none reaching quite to the bottom. These recesses are so deep as to form great openings in the midst of the grove; they penetrate almost to the covert: but the clumps being all equally suspended from the wood; and a line of open plantation, though sometimes narrow, running constantly along the top; a continuation of grove is preserved, and the connexion between the parts is never broken. Even a group, which near one of the extremities stands out quite detached, is still in style so similar to the rest as not to lose all relation. Each of these clumps is composed of several others still more intimately united; each is full of groups, sometimes of no more than two trees, sometimes of four or five, and now and then in larger clusters; an irregular waving line, issuing from some little crowd, loses itself in the next; or a few scattered trees drop in a more distant succession from the one to the other. The intervals, winding here like a glade, and widening there into broader openings, differ in extent, in figure, and direction; but all the groups, the lines, and the intervals, are collected together into large general clumps, each of which is at the same time both compact and free, identical and various. The whole is a place wherein to tarry with secure delight, or saunter with perpetual amusement.

† New Esher in Surry.

The grove at Esher place was planted by the same masterly hand; but the necessity of accommodating the young plantation to some large trees which grew there before, has confined its variety. The groups are few and small: there was not room for larger or for more; there were no opportunities to form continued narrow glades between opposite lines; the vacant spaces are therefore chiefly irregular openings, spreading every way, and great differences of distance between the trees are the principal variety; but the grove winds along the bank of a large river, on the side and at the foot of a very sudden ascent, the upper part of which is covered with wood. In one place, it presses close to the covert; retires from it in another; and stretches in a third across a bold recess, which runs up high into the thicket. The trees sometimes overspread the flat below; sometimes leave an open space to the river; at other times crown the brow of a large knoll, climb up a steep, or hang on a gentle declivity. These varieties in the situation more than compensate for the want of variety in the disposition of the trees; and the many happy circumstances which concur,

——————In Esher's peaceful grove,
Where Kent and nature vie for Pelham's love,

render this little spot more agreeable than any at Claremont. But though it was right to preserve the trees already standing, and not to sacrifice great present beauties to still greater in futurity; yet this attention has been a restraint; and the grove at Claremont, considered merely as a plantation, is in delicacy of taste, and fertility of invention, superior to that at Esher.

It is, however, possible to secure both a present and a future effect, by fixing first on a disposition which will be beautiful when the trees are large, and then intermingling another which is agreeable while they are small. These occasional trees are hereafter to be taken away; and must be removed in time, before they become prejudicial to the others.

The consequence of variety in the disposition, is variety in the light and shade of the grove; which may be improved by the choice of the trees. Some are impenetrable to the fiercest sunbeam; others let in here and there a ray between the large masses of their foliage; and others, thin both of boughs and of leaves, only chequer the around. Every degree of light and shade, from a glare to obscurity, may be managed, partly by the number, and partly by the texture, of the trees. Differences only in the manner of their growths have also corresponding effects: there is a closeness under those whose branches descend low, and spread wide; a space and liberty where the arch above is high; and frequent transitions from the one to the other are very pleasing. These still are not all the varieties of which the interior of a grove is capable; trees, indeed, whose branches nearly reach the ground, being each a sort of thicket, are inconsistent with an open plantation: but though some of the characteristic distinctions are thereby excluded, other varieties more minute succeed in their place; for the freedom of passage throughout brings every tree in its turn near to the eye, and subjects even differences in foliage to observation. These, slight as they may seem, are agreeable when they occur; it is true, they are not regretted when wanting; but a defect of ornament is not necessarily a blemish.

3. It has been already observed, that *clumps* differ only

only in extent from woods, if they are close; or from groves, if they are open: they are small woods, and small groves, governed by the same principles as the larger, after allowances made for their dimensions. But besides the properties they may have in common with woods or with groves, they have others peculiar to themselves which require examination.

They are either *independent* or *relative*: when independent, their beauty, as single objects, is solely to be attended to; when relative, the beauty of the individuals must be sacrificed to the effect of the whole, which is the greater consideration.

The *occasions* on which independent clumps may be applied, are many. They are often desirable as beautiful objects in themselves; they are sometimes necessary to break an extent of lawn, or a continued line whether of ground or of plantation; but on all occasions a jealousy of art constantly attends them, which irregularity in their figure will not always alone remove. Though elevations show them to advantage, yet a hillock evidently thrown up on purpose to be crowned with a clump, is artificial to a degree of disgust: some of the trees should therefore be planted on the sides, to take off that appearance. The same expedient may be applied to clumps placed on the brow of a hill, to interrupt its sameness: they will have less ostentation of design, if they are in part carried down either declivity. The objection already made to planting many along such a brow, is on the same principle: a single clump is less suspected of art; if it be an open one, there can be no finer situation for it, than just at the point of an abrupt hill, or on a promontory into a lake or a river. It is in either a beautiful termination, distinct by its position, and enlivened by an expanse of sky or of water about and beyond it. Such advantages may balance little defects in its form: but they are lost if other clumps are planted near it; art then intrudes, and the whole is displeasing.

But though a multiplicity of clumps, when each is an independent object, seldom seems natural; yet a number of them may, without any appearance of art, be admitted into the same scene, if they bear a *relation* to each other: if by their succession they diversify a continued outline of wood, if between them they form beautiful glades, if altogether, they cast an extensive lawn into an agreeable shape, the *effect* prevents any scrutiny into the means of producing it. But when the reliance on that effect is so great, every other consideration must give way to the beauty of the whole. The figure of the glade, of the lawn, or of the wood, are principally to be attended to: the finest clumps, if they do not fall easily into the great lines, are blemishes; their connexions, their contrasts, are more important than their forms.

5

III. WATER. All inland water is either *running* or *stagnated*. When stagnated, it forms a *lake* or a *pool*, which differ only in extent; and a *pool* and a *pond* are the same. Running waters are either a *rivulet*, a *river*, or a *rill;* and these differ only in breadth: a *rivulet* and a *brook* are synonymous terms; a *stream* and a *current* are general names for all.

1. Space or expansion is essential to a *lake*. It cannot be too large as a subject of description or of contemplation; but the eye receives little satisfaction when it has not a form on which to rest: the ocean itself hardly atones by all its grandeur for its infinity; and a prospect of it is, therefore, always most agreeable, when in some part, at no great distance, a reach of shore, a promontory, or an island, reduces the immensity into shape. An artificial lake, again, may be comparatively extravagant in its dimensions. It may be so out of proportion to its appendages, as to seem a waste of water; for all size is in some respects relative: if this exceeds its due dimensions, and if a flatness of shore beyond it adds still to the dreariness of the scene; wood to raise the banks, and objects to distinguish them, are the remedies to be employed. If the length of a piece of water be too great for its breadth, so as to destroy all idea of circuity, the extremities should be considered as too far off, and made important to give them proximity; while at the same time the breadth may be favoured, by keeping down the banks on the sides. On the same principle, if the lake be too small, a low shore will, in appearance, increase the extent.

Water.

But it is not necessary that the whole scene be bounded: if form be impressed on a considerable part, the eye can, without disgust, permit a large reach to stretch beyond its ken; it can even be pleased to observe a tremulous motion in the horizon, which shows that the water has not there yet attained its termination. Still short of this, the extent may be kept in uncertainty; a hill or a wood may conceal one of the extremities, and the country beyond it, in such a manner as to leave room for the supposed continuation of so large a body of water. Opportunities to choose this shape are frequent, and it is the most perfect of any: the scene is closed, but the extent of the lake is undetermined; a complete form is exhibited to the eye, while a boundless range is left open to the imagination.

But mere form will only give content, not delight: that depends upon the outline, which is capable of exquisite beauty; and the *bays*, the *creeks*, and the *promontories*, which are ordinary parts of that outline, together with the accidents of *islands*, of *inlets*, and of *outlets* to rivers, are in their shapes and their combinations an inexhaustible fund of variety.

Bays, creeks, and promontories, however, though extremely beautiful, should not be very numerous: for a shore broken into little points and hollows has no certainty of outline; it is only ragged, not diversified; and the distinctness and simplicity of the great parts are hurt by the multiplicity of subdivisions. But islands, though the channels between them be narrow, do not so often derogate from greatness: they intimate a space beyond them whose boundaries do not appear; and remove to a distance the shore which is seen in perspective between them. Such partial interruptions of the sight suggest ideas of extent to the imagination.

2. Though the windings of a *river* are proverbially descriptive of its course; yet without being perpetually wreathed, it may be natural. Nor is the character expressed only by the turnings. On the contrary, if they are too frequent and sudden, the current is reduced into a number of separate pools, and the idea of progress is obscured by the difficulty of tracing it. Length is the strongest symptom of continuation: 6 Of a River.

long

Water. Ibid.

long reaches are therefore characteristic of a river, and they conduce much to its beauty; each is a considerable piece of water, and variety of beautiful forms may be given to their outlines.

A river requires a number of *accompaniments*. The changes in its course furnish a variety of situations; while the fertility, convenience, and amenity, which attend it, account for all appearances of inhabitants and improvement. Profusion of ornament on a fictitious river, is a just imitation of cultivated nature. Every species of building, every style of plantation, may abound on the banks; and whatever be their characters, their proximity to the water is commonly the happiest circumstance in their situation. A lustre is from thence diffused on all around; each derives an importance from its relation to this capital feature; those which are near enough to be reflected, immediately belong to it; those at a greater distance still share in the animation of the scene; and objects totally detached from each other, being all attracted towards the same interesting connexion, are united into one composition.

In the front of Blenheim was a deep broad valley, which abruptly separated the castle from the lawn and the plantations before it; even a direct approach could not be made without building a monstrous bridge over the vast hollow; but this forced communication was only a subject of raillery; and the scene continued broken into two parts, absolutely distinct from each other. This valley has been lately flooded: it is not filled; the bottom only is covered with water; the sides are still very high; but they are no longer the steeps of a chasm, they are the bold shores of a noble river. The same bridge is standing without alteration: but no extravagance remains; the water gives it propriety. Above it the river first appears, winding from behind a small thick wood in the valley; and soon taking a determined course, it is then broad enough to admit an island filled with the finest trees; others corresponding to them in growth and disposition, stand in groups on the banks, intermixed with younger plantations. Immediately below the bridge, the river spreads into a large expanse: the sides are open lawn. On that furthest from the house formerly stood the palace of Henry II. celebrated in many an ancient ditty by the name of Fair Rosamond's Bower. A little clear spring, which rises there, is by the country people still called Fair Rosamond's Well. The spot is now marked by a single willow. Near it is a fine collateral stream, of a beautiful form, retaining its breadth as far as it is seen, and retiring at last behind a hill from the view. The main river, having received this accession, makes a gentle bend: then continues for a considerable length in one wide direct reach; and, just as it disappears, throws itself down a high cascade, which is the present termination. On one of the banks of this reach is the garden: the steeps are there diversified with thickets and with glades; but the covert prevails, and the top is crowned with lofty trees. On the other side is a noble hanging wood in the park: it was depreciated when it sunk into a hollow, and was poorly lost in the bottom; but it is now a rich appendage to the river, falling down an easy slope quite to the water's edge, where, with overshadowing, it is reflected on the surface. Another face of the same wood borders the collateral stream, with an outline more indented and various: while a very large irregular clump adorns the opposite declivity. This clump is at a considerable distance from the principal river: but the stream it belongs to brings it down to connect with the rest; and the other objects, which were before dispersed, are now, by the interest of each in a relation, which is common to all, collected into one illustrious scene. The castle itself is a prodigious pile of building; which, with all the faults of the architecture, will never seem less than a truly princely habitation; and the confined spot where it was placed, on the edge of an abyss, is converted into a proud situation, commanding a beautiful prospect of water, and open to an extensive lawn, adequate to the mansion, and an emblem of its domain. In the midst of this lawn stands a column, a stately trophy, recording the exploits of the duke of Marlborough and the gratitude of Britain. Between this pillar and the castle is the bridge, which now, applied to a subject worthy of it, is established in all the importance due to its greatness. The middle arch is wider than the Rialto, but not too wide for the occasion; and yet that is the narrowest part of the river; but the length of the reaches is everywhere proportioned to their breadth. Each of them is alone a noble piece of water; and the last, the finest of all, loses itself gradually in a wood, which on that side is also the boundary of the lawn, and rises into the horizon. All is great in the front of Blenheim: but in that vast space no void appears; so important are the parts, so magnificent the object. The plain is extensive, the valley is broad, the wood is deep. Though the intervals between the building are large, they are filled with the grandeur which buildings of such dimensions and so much pomp diffuse all around them; and the river in its long varied course, approaching to every object, and touching upon every part, spreads its influence over the whole.

In the composition of this scene, the river, both as a part itself, and as uniting the other parts, has a principal share. But water is not lost though it be in so confined or so concealed a spot as to enter into no view; it may render that spot delightful. It is capable of the most exquisite beauty in its form; and though not in space, may yet in disposition have pretensions to greatness; for it may be divided into several branches, which will form a cluster of islands all connected together, make the whole place irriguous, and, in the stead of extent, supply a quantity of water. Such a sequestered scene usually owes its retirement to the trees and the thickets with which it abounds; but, in the disposition of them, one distinction should be constantly attended to. A river flowing through a wood which overspreads one continued surface of ground, and a river between two woods, are in very different circumstances. In the latter case, the woods are separate; they may be contrasted in their forms and their characters, and the outline of each should be forcibly marked. In the former no outline ought to be discernible; for the river passes between trees, not between boundaries; and though in the progress of its course, the style of the plantations may be often changed, yet on the opposite banks a similarity should constantly prevail, that the identity of the wood may never be doubtful.

A

Water.

A river between two woods may enter into a view; and then it must be governed by the principles which regulate the conduct and the accompaniments of a river in an open exposure. But when it runs through a wood, it is never to be seen in a prospect; the place is naturally full of obstructions; and a continued opening, large enough to receive a long reach, would seem an artificial cut. The river must therefore necessarily wind more than in crossing a lawn where the passage is entirely free. But its influence will never extend so far on the sides: the buildings must be near the banks: and, if numerous, will seem crowded, being all in one track, and in situations nearly alike. The scene, however, does not want variety; on the contrary, none is capable of more. The objects are not indeed so different from each other as in an open view; but they are very different, and in much greater abundance; for this is the interior of a wood, where every tree is an object, every combination of trees a variety, and no large intervals are requisite to distinguish the several dispositions; the grove, the thicket, or the groups, may prevail, and their forms and their relations may be constantly changed, without restraint of fancy, or limitation of number.

Water is so universally and so deservedly admired in a prospect, that the most obvious thought in the management of it, is to lay it as open as possible; and purposely to conceal it would generally seem a severe self-denial: yet so many beauties may attend its passage through a wood, that larger portions of it might be allowed to snch retired scenes than are commonly spared from the view, and the different parts in different styles would be fine contrasts to each other. If the water at Wotton * were all exposed, a walk of near two miles along the banks would be of a tedious length, from the want of those changes of the scene which now supply through the whole extent a succession of perpetual variety. The extent is so large as to admit of a division into four principal parts, all of them great in style and in dimensions, and differing from each other both in character and situation. The two first are the least. The one is a reach of river, about the third of a mile in length, and of a competent breadth, flowing through a lovely mead, open in some places to views of beautiful hills in the country, and adorned in others with clumps of trees, so large, that their branches stretch quite across, and form a high arch over the water. The next seems to have been once a formal basin encompassed with plantations, and the appendages on either side still retain some traces of regularity: but the shape of the water is free from them; the size is about 14 acres; and out of it issue two broad collateral streams, winding towards a large river, which they are seen to approach, and supposed to join. A real junction is however impossible, from the difference of the levels; but the terminations are so artfully concealed, that the deception is never suspected, and when known is not easily explained. The river is the third great division of the water; a lake into which it falls, is the fourth. These two do actually join; but their characters are directly opposite; the scenes they belong to are totally distinct; and the transition from the one to the other is very gradual; for an island near the conflux, dividing the breadth, and concealing the end of the lake, moderates for some way the space; and permitting it to expand but by degrees, raises an idea of greatness, from uncertainty accompanied with increase. The reality does not disappoint the expectation; and the island, which is the point of view, is itself equal to the scene: it is large, and high above the lake; the ground is irregularly broken; thickets hang on the sides; and towards the top is placed an Ionic portico, which commands a noble extent of water, not less than a mile in circumference, bounded on one side with wood, and open on the other to two sloping lawns, the least of an hundred acres, diversified with clumps, and bordered by plantations. Yet this lake, when full in view, and with all the importance which space, form, and situation can give, is not more interesting than the sequestered river, which has been mentioned as the third great division of the water. It is just within the verge of a wood, three quarters of a mile long, everywhere broad, and its course is such as to admit of infinite variety without any confusion. The banks are cleared of underwood; but a few thickets still remain, and on one side an impenetrable covert soon begins: the interval is a beautiful grove of oaks, scattered over a green sward of extraordinary verdure. Between these trees and these thickets the river seems to glide gently along, constantly winding, without one short turn or one extended reach in the whole length of the way. This even temper in the stream suits the scenes through which it passes; they are in general of a very sober cast, not melancholy, but grave; never exposed to a glare; never darkened with gloom; nor, by strong contrasts of light and shade, exhibiting the excess of either. Undisturbed by an extent of prospect without, or a multiplicity of objects within, they retain at all times a mildness of character; which is still more forcibly felt when the shadows grow faint as they lengthen, when a little rustling of birds in the spray, the leaping of the fish, and the fragrancy of the woodbine, denote the approach of evening; while the setting sun shoots its last gleams on a Tuscan portico, which is close to the great basin, but which from a seat near this river is seen at a distance, through all the obscurity of the wood, glowing on the banks, and reflected on the surface of the water. In another still more distinguished spot is built an elegant bridge, with a colonnade upon it, which not only adorns the place where it stands, but is also a picturesque object to an octagon building near the lake, where it is shewn in a singular situation, overarched, encompassed, and backed with wood, without any appearance of the water beneath. This building in return is also an object from the bridge; and a Chinese room, in a little island just by, is another: neither of them are considerable, and the others which are visible are at a distance; but more or greater adventitious ornaments are not required in a spot so rich as this in beauties peculiar to its character. A profusion of water pours in from all sides round upon the view; the opening of the lake appears; a glimpse is caught of the large basin: one of the collateral streams is full in sight, and the bridge itself is in the midst of the finest part of the river: all seem to communicate the one with the other. Though thickets often intercept, and groups perplex the view, yet they never break the connexion between the several pieces of water; each may still be traced along

* Vale of Aylesbury, Buckinghamshire.

along

Water. Ibid. along large branches or little catches; which in some places are overshadowed and dim; in others glisten through a glade, or glimmer between the boles of trees in a distant perspective; and in one, where they are quite lost to the view, some arches of the stone bridge, but partially seen among the wood, preserve their connexion.

7 Of a Rill and a Rivulet. 3. If a large river may sometimes, a smaller current undoubtedly may often, be conducted through a wood: it seldom adorns, it frequently disfigures, a prospect, where its course is marked, not by any appearance of water, but by a confined line of clotted grass, which disagrees with the general verdure. A *Rivulet* may, indeed, have consideration enough for a home scene, though it be open; but a *Rill* is always most agreeable when most retired from public view. Its characteristic excellencies are vivacity and variety, which require attention, leisure, and silence, that the eye may pore upon the little beauties, and the ear listen to the low murmurs of the stream without interruption. To such indulgence a confined spot only is favourable; a close copse is therefore often more acceptable than a high wood, and a sequestered valley at all times preferable to any open exposure: a single rill at a very little distance is a mere water course; it loses all its charms; it has no importance in itself, and bears no proportion to the scene. A number of little streams have indeed an effect in any situation, but not as objects; they are interesting only on account of the character they express, the irriguous appearance which they give to the whole.

The full tide of a large river has more force than activity, and seems too unwieldy to allow of very quick transitions. But in a rill, the agility of its motions accounts for every caprice; frequent windings disguise its insignificance; short turnings show its vivacity; sudden changes in the breadth are a species of its variety; and however fantastically the channel may be wreathed, contracted, and widened, it still appears to be natural. We find an amusement in tracing the little stream through all the intricacies of its course, and in seeing it force a passage through a narrow strait, expatiate on every opportunity, struggle with obstructions, and puzzle out its way. A rivulet, which is the mean betwixt a river and a rill, partakes of the character of both: it is not licensed to the extravagance of the one, nor under the same restraints as the other: it may have more frequent bends than the river, longer reaches than a rill: the breadth of a stream determines whether the principal beauty results from extent or from variety.

The murmurs of a rill are amongst the most pleasing circumstances which attend it. If the bed of the stream be rough, mere declivity will occasion a constant rippling noise: when the current drops down a descent, though but of a few inches, or forcibly bubbles up from a little hollow, it has a deep gurgling tone, not uniformly continued, but incessantly repeated, and therefore more engaging than any. The flattest of all, is that sound rather of the splashing than the fall of water, which an even gentle slope, or a tame obstruction, will produce: this is less pleasing than the others; but none should be entirely excluded: all in their turns are agreeable; and the choice of them is much in our power. By observing their causes, we may often find the means to strengthen, to weaken, or to change them; and the addition or removal of a single stone, or a few pebbles, will sometimes be sufficient for the purpose.

8 Of Cascades. A rill cannot pretend to any sound beyond that of a little water fall: the roar of a cascade belongs only to a larger stream; but it may be produced by a rivulet to a considerable degree, and attempts to do more have generally been unsuccessful. A vain ambition to imitate nature in her great extravagancies betrays the weakness of art. Though a noble river, throwing itself headlong down a precipice, be an object truly magnificent, it must however be confessed, that in a single sheet of water there is a formality which its vastness alone can cure. But the height, not the breadth, is the wonder: when it falls not more than a few feet, the regularity prevails; and its extent only serves to expose the vanity of affecting the style of a cataract in an artificial cascade. It is less exceptionable if divided into several parts: for then each separate part may be wide enough for its depth; and in the whole, variety, not greatness, will be the predominant character. But a structure of rough, large, detached stones, cannot easily be contrived of strength sufficient to support a great weight of water: it is sometimes from necessity almost smooth and uniform, and then it loses much of its effects. Several little falls in succession are preferable to one great cascade which in figure or in motion approaches to regularity.

When greatness is thus reduced to number, and length becomes of more importance than breadth, a rivulet vies with a river: and it more frequently runs in a continued declivity, which is very favourable to such a succession of falls. Half the expence and labour which are sometimes bestowed on a river, to give it at the best a forced precipitancy in one spot only, would animate a rivulet through the whole of its course. And, after all, the most interesting circumstance in falling waters is their animation. A great cascade fills us with surprise: but all surprise must cease; and the motion, the agitation, the rage, the froth, and the variety of the water, are finally the objects which engage the attention: for these a rivulet is sufficient; and they may there be produced without that appearance of effort which raises a suspicion of art.

To obviate such a suspicion, it may be sometimes expedient to begin the descent out of sight; for the beginning is the difficulty: if that be concealed, the subsequent falls seem but a consequence of the agitation which characterises the water at its first appearance; and the imagination is, at the same time, let loose to give ideal extent to the cascades. When a stream issues from a wood, such management will have a great effect: the bend of its course in an open exposure may afford frequent opportunities for it; and sometimes a low broad bridge may furnish the occasion: a little fall hid under the arch will create a disorder; in consequence of which, a greater cascade below will appear very natural.

Of Rocks. IV. ROCKS. Rocks are themselves too vast and too stubborn to submit to our controul; by the addition or removal of appendages which we can command, parts may be shown or concealed, and the characters with their impressions may be weakened or enforced:

forced: to adopt the accompaniments accordingly, is the utmost ambition of art when rocks are the subject.

Their most distinguished characters are, *dignity*, *terror*, and *fancy*: the expressions of all are constantly wild: and sometimes a rocky scene is only wild, without pretensions to any particular character.

Rills, rivulets, and cascades, abound among rocks: they are natural to the scene; and such scenes commonly require every accompaniment which can be procured for them. Mere rocks, unless they are particularly adapted to certain impressions, though they may surprise, cannot be long engaging, if the rigour of their character be not softened by circumstances which may belong either to these or to more cultivated spots: and when the dreariness is extreme, little streams and waterfalls are of themselvess insufficient for the purpose; an intermixture of vegetation is also necessary, and on some occasions even marks of inhabitants are proper.

Large clefts, sloping or precipitous, with a dale at bottom, furnish scenes of the wildest nature. In such spots, verdure alone will give some relief to the dreariness of the scene; and shrubs or bushes, without trees, are a sufficiency of wood: the thickets may also be extended by the creeping plants, such as pyracantha, vines, and ivy, to wind up the sides or cluster on the tops of the rocks. And to this vegetation may be added some symptoms of inhabitants, but they must be slight and few; the use of them is only to cheer, not to destroy, the solitude of the place; and such therefore should be chosen as are sometimes found in situations retired from public resort; a cottage may be lonely, but it must not here seem ruinous and neglected; it should be tight and warm, with every mark of comfort about it, to which its position in some sheltered recess may greatly contribute. A cavity also in the rocks, rendered easy of access, improved to a degree of convenience, and maintained in a certain state of preservation, will suggest similar ideas of protection from the bitterest inclemencies of the sky, and even of occasional refreshment and repose. But we may venture still further; a mill is of necessity often built at some distance from the town which it supplies; and here it would at the same time apply the water to a use, and increase its agitation. The dale may besides be made the haunt of those animals, such as goats, which are sometimes wild, and sometimes domestic; and which accidentally appearing, will divert the mind from the sensations natural to the scene, but not agreeable if continued long without interruption. These and such other expedients will approximate the severest retreat to the habitations of men, and convert the appearance of a perpetual banishment into that of a temporary retirement from society.

But too strong a force on the nature of the place alway fails. A winding path, which appears to be worn, not cut, has more effect than a high road, all artificial and level, which is too weak to overbear, and yet contradicts the general idea. The objects therefore to be introduced must be those which hold a mean between solitude and population; and the inclination of that choice towards either extreme, should be directed by the degree of wildness which prevails; for though that runs sometimes to an excess which requires correction, at other times it wants encouragement, and at all times it ought to be preserved: it is the predominant character of rocks, which mixes with every other and to which all the appendages must be accommodated; and they may be applied so as greatly to increase it: a licentious irregularity of wood and of ground, and a fantastic conduct of the streams, neither of which would be tolerated in the midst of cultivation, become and improve romantic rocky spots; even buildings, partly by their style, but still more by their position, in strange, difficult, or dangerous situations, distinguish and aggravate the native extravagancies of the scene.

Greatness is a chief ingredient in the character of *dignity*, with less of wildness than in any other. The effect here depends more upon amplitude of surface, than variety of forms. The parts, therefore, must be large: if the rocks are only high, they are but stupendous, not majestic: breadth is equally essential to their greatness; and every slender, every grotesque shape, is excluded. Art may interpose to show these large parts to the eye, and magnify them to the imagination, by taking away thickets which stretch quite across the rocks, so as to disguise their dimensions; or by filling with wood the small intervals between them, and thus, by concealing the want, preserving the appearance of continuation. When rocks retire from the eye down a gradual declivity, we can, by raising the upper ground, deepen the fall, lengthen the perspective, and give both height and extent to those at a distance: this effect may be still increased by covering that upper ground with a thicket, which shall cease or be lowered, as it descends. A thicket, on other occasions, makes the rocks which rise out of it seem larger than they are. If they stand upon a bank overspread with shrubs, their beginning is at the least uncertain; and the presumption is, that they start from the bottom. Another use of this brushy underwood is to conceal the fragments and rubbish which have fallen from the sides and the brow, and which are often unsightly. Rocks are seldom remarkable for the elegance of their forms; they are too vast, and too rude, to pretend to delicacy: but their shapes are often agreeable; and we can affect those shapes to a certain degree, at least we can cover many blemishes in them, by conducting the growth of shrubby and creeping plants about them.

For all these purposes mere underwood suffices: but for greater effects larger trees are requisite: they are worthy of the scene; and not only improvements, but accessions to its grandeur: we are used to rank them among the noblest objects of nature; and when we see that they cannot aspire to the midway of the heights around them, the rocks are raised by the comparison. A single tree is, therefore, often preferable to a clump: the size, though really less, is more remarkable: and clumps are besides generally exceptionable in a very wild spot, from the suspicions of art which attends them; but a wood is free from that suspicion, and its own character of greatness recommends it to every scene of magnificence.

On the same principle all possible consideration should be given to the streams. No number of little rills are equal to one broad river; and in the principal current, some varieties may be sacrificed to importance: but a degree of strength should always be preserved: the water, though it needs not be furious, should not be dull;

Rocks. Ibid.

dull; for dignity, when most serene, is not languid; and space will hardly atone for want of animation.

This character does not exclude marks of inhabitants, though it never requires them to tame its wildness: and without inviting, it occasionally admits an intermixture of vegetation. It even allows of buildings intended only to decorate the scene: but they must be adequate to it, both in size and in character. And if cultivation is introduced, that too should be conformable to the rest; not a single narrow patch cribbed out of the waste; but the confines of a country shelving into the vale, and suggesting the idea of extent: nothing trivial ought to find admittance. But, on the other hand, no extravagance is required to support it; strange shapes in extraordinary positions, enormous weights unaccountably sustained, trees rooted in the sides, and torrents raging at the foot of the rocks, are at the best needless excesses. There is a temperance in dignity, which is rather hurt by a wanton violence on the common order of nature.

The terrors of a scene in nature are like those of a dramatic representation: they give an alarm; but the sensations are agreeable, so long as they are kept to such as are allied only to terror, unmixed with any that are horrible and disgusting. Art may therefore be used to heighten them, to display the objects which are distinguished by greatness, to improve the circumstances which denote force, to mark those which intimate danger, and to blend withal here and there a cast of melancholy.

Greatness is as essential to the character of *terror* as to that of dignity: vast efforts in little objects are but ridiculous; nor can force be supposed upon trifles incapable of resistance. On the other hand, it must be allowed, that exertion and violence supply some want of space. A rock wonderfully supported, or threatening to fall, acquires a greatness from its situation, which it has not in dimensions; so circumstanced, the size appears to be monstrous: a torrent has a consequence which a placid river of equal breadth cannot pretend to; and a tree, which would be inconsiderable in the natural soil, becomes important when it bursts forth from a rock.

Such circumstances should be always industriously sought for. It may be worth while to cut down several trees, in order to exhibit one apparently rooted in the stone. By the removal perhaps of only a little brushwood, the alarming disposition of a rock, strangely undermined, rivetted, or suspended, may be shown; and if there be any soil above its brow, some trees planted there, and impending over it, will make the object still more extraordinary. As to the streams, great alterations may generally be made in them: and therefore it is of use to ascertain the species proper to each scene, because it is in our power to enlarge or contract their dimensions; to accelerate or retard their rapidity; to form, increase, or take away obstructions; and always to improve, often to change, their characters.

Inhabitants furnish frequent opportunities to strengthen the appearances of force, by giving intimations of danger. A house placed at the edge of a precipice, any building on the pinnacle of a crag, makes that situation seem formidable, which might otherwise have been unnoticed: a steep, in itself not very remarkable, becomes alarming, when a path is carried aslant up the side: a rail on the brow of a perpendicular fall, shows that the height is frequented and dangerous: and a common foot bridge thrown over a cleft between rocks has a still stronger effect. In all these instances, the imagination immediately transports the spectator to the spot, and suggests the idea of looking down such a depth; in the last, that depth is a chasm, and the situation is directly over it.

Rocks.

In other instances, exertion and danger seem to attend the occupations of the inhabitants:

> ————Half way down
> Hangs one that gathers samphire; dreadful trade!

is a circumstance chosen by the great poet of nature, to aggravate the terror of the scene he describes.

The different species of rocks often meet in the same place, and compose a noble scene, which is not distinguished by any particular character; it is only when one eminently prevails, that it deserves such a preference as to exclude every other. Sometimes a spot, remarkable for nothing but its wildness, is highly romantic: and when this wildness rises to *fancy*; when the most singular, the most opposite forms and combinations are thrown together; then a mixture also of several characters adds to the number of instances which there concur to display the inexhaustible variety of nature.

So much variety, so much fancy, are seldom found within the same extent as in Dovedale †. It is about two miles in length, a deep, narrow, hollow valley; both the sides are of rock; and the Dove in its passage between them is perpetually changing its course, its motion, and appearance. It is never less than ten, nor so much as twenty, yards wide, and generally about four feet deep; but transparent to the bottom, except when it is covered with a foam of the purest white, under waterfalls, which are perfectly lucid. These are very numerous, but very different. In some places they stretch straight across, or aslant the stream: in others, they are only partial; and the water either dashes against the stones, and leaps over them, or, pouring along a steep, rebounds upon those below: sometimes it rushes through the several openings between them; sometimes it drops gently down; and at other times it is driven back by the obstruction, and turns into an eddy. In one particular spot, the valley, almost closing, leaves hardly a passage for the river, which, pent up, and struggling for a vent, rages, and roars, and foams, till it has extricated itself from the confinement. In other parts, the stream, though never languid, is often gentle; flows round a little desert island, glides between bits of bulrushes, disperses itself among tufts of grass or of moss, bubbles about a water dock, or plays with the slender threads of aquatic plants which float upon the surface. The rocks all along the dale vary as often in their structure as the stream in its motion. In one place, an extended surface gradually diminishes from a broad base almost to an edge: in another, a heavy top hanging forwards, overshadows all beneath: sometimes many different shapes are confusedly tumbled together; and sometimes they are broken into slender sharp pinnacles, which are upright, often two or three together, and often in more numerous clusters. On this side of the dale,

† Near Ashbourn in Derbyshire.

dale, they are universally bare; on the other, they are intermixed with wood; and the vast height of both the sides, with the narrowness of the interval between them, produces a further variety: for whenever the sun shines from behind the one, the form of it is distinctly and completely cast upon the other; the rugged surface on which it falls diversifies the tints; and a strong reflected light often glares on the edge of the deepest shadow. The rocks never continue long in the same figure or situation, and are very much separated from each other: sometimes they form the sides of the valley, in precipices, in steeps, or in stages; sometimes they seem to rise in the bottom, and lean back against the hill; and sometimes they stand out quite detached, heaving up in cumbrous piles, or starting into conical shapes, like vast spars, 100 feet high; some are firm and solid throughout; some are cracked; and some, split and undermined, are wonderfully upheld by fragments apparently unequal to the weight they sustain. One is placed before, one over another, and one fills at some distance behind an interval between two. The changes in their disposition are infinite; every step produces some new combination; they are continually crossing, advancing, and retiring; the breadth of the valley is never the same 40 yards together: at the narrow pass which has been mentioned, the rocks almost meet at the top, and the sky is seen as through a chink between them: just by this gloomy abyss, is a wider opening, more light, more verdure, more cheerfulness than anywhere else in the dale. Nor are the forms and the situations of the rocks their only variety: many of them are perforated by large natural cavities, some of which open to the sky, some terminate in dark recesses, and through some are to be seen several more uncouth arches, and rude pillars, all detached, and retiring beyond each other, with the light shining in between them, till a rock far behind them closes the perspective: the noise of the cascades in the river echoes amongst them; the water may often be heard at the same time gurgling near, and roaring at a distance; but no other sounds disturb the silence of the spot: the only trace of men is a blind path, but lightly and but seldom trodden, by those whom curiosity leads to see the wonders they have been told of Dovedale. It seems indeed a fitter haunt for mere ideal beings: the whole has the air of enchantment. The perpetual shifting of the scenes; the quick transitions, the total changes, then the forms all around, grotesque as chance can cast, wild as nature can produce, and various as imagination can invent; the force which seems to have been exerted to place some of the rocks where they are now fixed immoveable, the magic by which others appear still to be suspended; the dark caverns, the illuminated recesses, the fleeting shadows, and the gleams of light glancing on the sides, or trembling on the stream; and the loneliness and the stillness of the place, all crowding together on the mind, almost realize the ideas which naturally present themselves in this region of romance and of fancy.

The solitude of such a scene is agreeable, on account of the endless entertainment which its variety affords, and in the contemplation of which both the eye and the mind are delighted to indulge: marks of inhabitants and cultivation would disturb that solitude; and ornamental buildings are too artificial in a place so absolutely free from restraint. The only accompaniments proper for it are wood and water; and by these sometimes improvements may be made. When two rocks similar in shape and position are near together, by skirting one of them with wood, while the other is left bare, a material distinction is established between them: if the streams be throughout of one character, it is in our power, and should be our aim, to introduce another. Variety is the peculiar property of the spot, and every accession to it is a valuable acquisition. On the same principle, endeavours should be used not only to multiply, but to aggravate differences, and to increase distinctions into contrasts: but the subject will impose a caution against attempting too much. Art must almost despair of improving a scene, where nature seems to have exerted her invention.

§ 2. *Of Factitious Accompaniments.*

Fence, &c.

These consist of Fences, Walks, Roads, Bridges, Seats, and Buildings.

Practical Treatise on Planting and Gardening, p. 593, &c.

"I. The FENCE, where the place is large, becomes necessary; yet the eye dislikes constraint. Our ideas of liberty carry us beyond our own species: the imagination feels a dislike in seeing even the brute creation in a state of confinement. The birds wafting themselves from wood to grove are objects of delight; and the hare appears to enjoy a degree of happiness unknown to the barriered flock. Besides, a tall fence frequently hides from the sight objects the most pleasing; not only the flocks and herds themselves, but the surface they graze upon. These considerations have brought the unseen fence into general use.

This species of barrier it must be allowed incurs a degree of deception, which can scarcely be warranted upon any other occasion. In this instance, however, it is a species of fraud which we observe in nature's practice: how often have we seen two distinct herds feeding to appearance in the same extended meadow; until coming abruptly upon a deep sunk rivulet, or an unfordable river, we discover the deception.

Besides the sunk fence, another sort of unseen barrier may be made, though by no means equal to that, especially if near the eye. This is constructed of paling, painted of the invisible green. If the colour of the back ground were permanent, and that of the paint made exactly to correspond with it, the deception would at a distance be complete; but back grounds in general changing with the season, this kind of fence is the less eligible.

Clumps and patches of woodiness scattered promiscuously on either side of an unseen winding fence, assist very much in doing away the idea of constraint. For by this means

> The wand'ring flocks that browse between the shades,
> Seem oft to pass their bounds; the dubious eye
> Decides not if they crop the mead or lawn.
>
> MASON.

"II. The WALK, in extensive grounds, is as necessary as the fence. The beauties of the place are disclosed that they may be seen; and it is the office of the walk

Bridge, &c.

Ibid.

walk to lead the eye from view to view; in order that whilst the tone of health is preserved by the favourite exercise of nature, the mind may be thrown into unison by the harmony of the surrounding objects.

The direction of the walk must be guided by the points of view to which it leads, and the nature of the ground it passes over: it ought to be made subservient to the natural impediments (the ground, wood, and water) which fall in its way, without appearing to have any direction of its own. It can seldom run with propriety any distance in a straight line; a thing which rarely occurs in a natural walk. The paths of the Negroes and the Indians are always crooked; and those of the brute creation are very similar. Mr Mason's description of this path of nature is happily conceived.

> The peasant driving through each shadowy lane
> His team, that bends beneath th' incumbent weight
> Of laughing Ceres, marks it with his wheel;
> At night and morn, the milkmaid's careless step
> Has through yon pasture green, from stile to stile
> Imprest a kindred curve: the scudding hare
> Draws to her dew-sprent seat, o'er thymy heaths,
> A path as gently waving————
>
> *Eng. Gard.* v. 60.

"III. The **ROAD** may be a thing of necessity, as an approach to the mansion; or a matter of amusement only, as a drive or a ride, from which the grounds and the surrounding country may be seen to advantage. It should be the study of the artist to make the same road answer, as far as may be, the twofold purpose.

The road and the walk are subject to the same rule of nature and use. The direction ought to be natural and easy, and adapted to the purpose intended. A road of necessity ought to be straighter than one of mere conveniency: in this, recreation is the predominant idea; in that, utility. But even in this the direct line may be dispensed with. The natural roads upon heaths and open downs, and the grassy glades and green roads across forests and extensive wastes, are proper subjects to be studied.

"IV. The **BRIDGE** should never be seen where it is not wanted: a useless bridge is a deception; deceptions are frauds; and fraud is always hateful, unless when practised to avert some greater evil. A bridge without water is an absurdity; and half a one stuck up as an eye-trap is a paltry trick, which, though it may strike the stranger, cannot fail of disgusting when the fraud is found out.

In low situations, and wherever water abounds, bridges become useful, and are therefore pleasing objects; they are looked for; and ought to appear not as objects of ornament only, but likewise as matters of utility. The walk or the road therefore ought to be directed in such a manner as to cross the water at the point in which the bridge will appear to the greatest advantage.

In the construction of bridges also, regard must be had to ornament and utility. A bridge is an artificial production, and as such it ought to appear. It ranks among the noblest of human inventions; the ship and the fortress alone excel it. Simplicity and firmness are the leading principles in its construction. Mr Wheatley's observation is just when he says, "The single wooden arch, now much in fashion, seems to me generally misapplied. Elevated without occasion so much above, it is totally detached from the river; it is often seen straddling in the air, without a glimpse of water to account for it; and the ostentation of it as an ornamental object, diverts all that train of ideas which its use as a communication might suggest." But we beg leave to differ from this ingenious writer when he tells us, "that it is spoiled if adorned; it is disfigured if only painted of any other than a dusky colour." In a rustic scene, where nature wears her own coarse garb, "the vulgar foot bridge of planks only guarded on one hand by a common rail, and supported by a few ordinary piles," may be in character; but amidst a display of ornamented nature, a contrivance of that kind would appear mean and paltry; and would be an affectation of simplicity rather than the lovely attribute itself. In cultivated scenes, the bridge ought to receive the ornaments which the laws of architectural taste allow; and the more polished the situation, the higher should be the style and finishings.

Buildings.

Ibid.

"V. **SEATS** have a twofold use; they are useful as places of rest and conversation, and as guides to the points of view in which the beauties of the surrounding scene are disclosed. Every point of view should be marked with a seat; and, speaking generally, no seat ought to appear but in some favourable point of view. This rule may not be invariable, but it ought seldom to be deviated from.

In the ruder scenes of neglected nature, the simple trunk, rough from the woodman's hands, and the butts or stools of rooted trees, without any other marks of tools upon them than those of the saw which severed them from their stems, are seats in character; and in romantic or recluse situations, the cave or the grotto are admissible. But wherever human design has been executed upon the natural objects of the place, the seat and every other artificial accompaniment ought to be in unison; and whether the bench or the alcove be chosen, it ought to be formed and finished in such a manner as to unite with the wood, the lawn, and the walk, which lie around it.

The colour of seats should likewise be suited to situations: where uncultivated nature prevails, the natural brown of the wood itself ought not to be altered; but where the rural art presides, white or stone colour has a much better effect.

Mr ...ley's ...vati... sum...

"VI. **BUILDINGS** probably were first introduced into gardens merely for convenience, to afford refuge from a sudden shower, and shelter against the wind; or, at the most, to be seats for a party; or for retirement. They have since been converted into objects, and now the original *use* is too often forgotten in the greater purposes to which they are applied: they are considered as objects only; the inside is totally neglected, and a pompous edifice frequently wants a room barely comfortable. Sometimes the pride of making a lavish display to a visitor without any regard to the owner's enjoyments, and sometimes too scrupulous an attention to the style of the structure, occasions a poverty and dulness within, which deprive the buildings of part of their utility. But in a garden they ought to be considered both as beautiful objects and as agreeable

greeable retreats: if a character becomes them, it is that of the scene they belong to; not that of their primitive application. A Grecian temple or Gothic church may adorn spots where it would be affectation to preserve that solemnity within which is proper for places of devotion: they are not to be exact models, subjects only of curiosity or study: they are also seats: and such seats will be little frequented by the proprietor; his mind must generally be indisposed to so much simplicity, and so much gloom, in the midst of gaiety, richness, and variety.

But though the interior of buildings should not be disregarded, it is by their exterior that they become *objects;* and sometimes by the one, sometimes by the other, and sometimes by both, they are entitled to be considered as *characters.*

1. As objects, they are designed either to *distinguish,* or to *break,* or to *adorn,* the scenes to which they are applied.

The differences between one wood, one lawn, one piece of water, and another, are not always very apparent: the several parts of a garden would, therefore, often seem similar, if they were not distinguished by buildings; but these are so observable, so obvious at a glance, so easily retained in the memory, they mark the spots where they are placed with so much strength, they attract the relation of all around with so much power, that parts thus distinguished can never be confounded together. Yet it by no means follows, that therefore every scene must have its edifice: the want of one is sometimes a variety; and other circumstances are often sufficiently characteristic: it is only when these too nearly agree, that we must have recourse to buildings for differences: we can introduce, exhibit, or contrast them as we please: the most striking object is thereby made a mark of distinction; and the force of this first impression prevents our observing the points of resemblance.

The uniformity of a view may be broken by similar means, and on the same principle: when a wide heath, a dreary moor, or a continual plain, is in prospect, objects which catch the eye supplant the want of variety: none are so effectual for this purpose as buildings. Plantations or water can have no very sensible effect, unless they are large and numerous, and almost change the character of the scene: but a small single building diverts the attention at once from the sameness of the extent; which it breaks, but does not divide; and diversifies, without altering its nature. The design, however, must not be apparent. The merit of a cottage applied to this purpose, consists in its being free from the suspicion: and a few trees near it will both enlarge the object, and account for its position. Ruins are a hackneyed device immediately detected, unless their style be singular, or their dimensions extraordinary. The semblance of an ancient British monument might be adapted to the same end, with little trouble, and great success. The materials might be brick, or even timber plastered over, if stone could not easily be procured: whatever they were, the fallacy would not be discernible; it is an object to be seen at a distance, rude, and large, and in character agreeable to a wild open view. But no building ought to be introduced, which may not in reality belong to such a situation: no Grecian temples, no Turkish mosques, no Egyptian obelisks or pyramids; none imported from foreign countries, and unusual here. The apparent artifice would destroy an effect, which is so nice as to be weakened, if objects proper to produce it are displayed with too much ostentation; if they seem to be contrivances, not accidents; and the advantage of their position appear to be more laboured than natural.

But in a garden, where objects are intended only to adorn, every species of architecture may be admitted, from the Grecian down to the Chinese; and the choice is so free, that the mischief most to be apprehended is an abuse of this latitude in the multiplicity of buildings. Few scenes can bear more than two or three: in some, a single one has a greater effect than any number: and a careless glimpse, here and there, of such as belong immediately to different parts, frequently enlivens the landscape with more spirit than those which are industriously shown. If the effect of a partial sight, or a distant view, were more attended to, many scenes might be filled, without being crowded; a greater number of buildings would be tolerated, when they seemed to be casual, not forced; and the animation, and the richness of the objects, might be had without pretence or display.

Too fond an ostentation of buildings, even of these which are principal, is a common error; and when all is done, they are not always shown to the greatest advantage. Though their symmetry and their beauties ought in general to be distinctly and fully seen, yet an oblique is sometimes better than a direct view: and they are often less agreeable objects when entire, than when a part is covered, or their extent is interrupted; when they are bosomed in wood, as well as backed by it; or appear between the stems of trees which rise before or above them; thus thrown into perspective, thus grouped and accompanied, they may be as important as if they were quite exposed, and are frequently more picturesque and beautiful.

But a still greater advantage arises from this management, in connecting them with the scene: they are considerable, and different from all around them; inclined therefore to separate from the rest; and yet they are sometimes still more detached by the pains taken to exhibit them: that very importance which is the cause of the distinction ought to be a reason for guarding against the independence to which it is naturally prone, and by which an object, which ought to be a part of the whole, is reduced to a mere individual. An elevated is generally a noble situation. When it is a point or pinnacle, the structure may be a continuation of the ascent; and on many occasions, some parts of the building may descend lower than others, and multiply the appearances of connexion: but an edifice in the midst of an extended ridge, commonly seems naked alone, and imposed upon the brow, not joined to it. If wood, to accompany it, will not grow there, it had better be brought a little way down the declivity; and then all behind, above, and about it, are so many points of contact, by which it is incorporated into landscape.

Accompaniments are important to a building; but they lose much of their effect when they do not appear to be casual. A little mount just large enough for it; a small piece of water below, of no other use than

Buildings.

than to reflect it; and a plantation close behind, evidently placed there only to give it relief; are as artificial as the structure itself, and alienate it from the scene of nature into which it is introduced, and to which it ought to be reconciled. These appendages therefore should be so disposed, and so connected with the adjacent parts, as to answer other purposes, though applicable to this: that they may be bonds of union, not marks of difference; and that the situation may appear to have been chosen at the most, not made, for the building.

In the choice of a situation, that which shows the building best ought generally to be preferred: eminence, relief, and every other advantage which can be, ought to be given to an object of so much consideration: they are for the most part desirable; sometimes necessary; and exceptionable only when, instead of rising out of the scene, they are forced into it, and a contrivance to procure them at any rate is avowed without any disguise. There are, however, occasions, in which the most tempting advantages of situation must be waved; the general composition may forbid a building in one spot, or require it in another; at other times, the interest of the particular group it belongs to may exact a sacrifice of the opportunities to exhibit its beauties and importance; and at all times, the pretensions of every individual object must give way to the greater effect of the whole.

11 Of those expressive of character.

2. The same structure which adorns as an object, may also be expressive as a *character*. Where the former is not wanted, the latter may be desirable: or it may be weak for one purpose, and strong for the other; it may be grave, or gay; magnificent, or simple: and according to its style, may or may not be agreeable to the place it is applied to. But mere consistency is not all the merit which buildings can claim: their characters are sometimes strong enough to *determine*, *improve*, or *correct*, that of the scene: and they are so conspicuous, and so distinguished, that whatever force they have is immediately and sensibly felt. They are fit therefore to make a first impression; and when a scene is but faintly characterized, they give at once a cast which spreads over the whole, and which the weaker parts concur to support, though perhaps they were not able to produce it.

Nor do they stop at fixing an uncertainty, or removing a doubt; they raise and enforce a character already marked: a temple adds dignity to the noblest, a cottage simplicity to the most rural, scenes; the lightness of a spire, the airiness of an open rotunda, the splendour of a continued colonnade, are less ornamental than expressive; others improve cheerfulness into gaiety, gloom into solemnity, and richness into profusion: a retired spot, which might have been passed unobserved, is noticed for its tranquillity, as soon as it is appropriated by some structure to retreat; and the most unfrequented place seems less solitary than one which appears to have been the haunt of a single individual, or even of a sequestered family, and is marked by a lonely dwelling, or the remains of a deserted habitation.

The means are the same, the application of them only is different, when buildings are used to correct the character of the scene; to enliven its dulness, mitigate its gloom, or to check its extravagance; and, on a variety of occasions, to soften, to aggravate, or to counteract, particular circumstances attending it. But care must be taken that they do not contradict too strongly the prevailing idea: they may lessen the dreariness of a waste, but they cannot give it amenity; they may abate horrors, but they will never convert them into graces; they may make a tame scene agreeable, and even interesting, not romantic; or turn solemnity into cheerfulness, but not into gaiety. In these, and in many other instances, they correct the character, by giving it an inclination towards a better which is not very different; but they can hardly alter it entirely: when they are totally inconsistent with it, they are at the best nugatory.

The great effects which have been ascribed to buildings do not depend upon those trivial ornaments and appendages which are often too much relied on; such as the furniture of a hermitage, painted glass in a Gothic church, and sculpture about a Grecian temple; grotesque or bacchanalian figures to denote gaiety, and death's heads to signify melancholy. Such devices are only descriptive, not expressive, of character; and must not be substituted in the stead of those superior properties, the want of which they acknowledge, but do not supply. They besides often require time to trace their meaning, and to see their application; but the peculiar excellence of buildings is, that their effects are instantaneous, and therefore the impressions they make are forcible. In order to produce such effects, the general style of the structure, and its position, are the principal considerations: either of them will sometimes be strongly characteristic alone; united, their powers are very great; and both are so important, that if they do not concur, at least they must not contradict one another.

Species and situations of buildings.

Every branch of architecture furnishes, on different occasions, objects proper for a garden; and there is no restraint on our selection, provided it be conformable to the style of the scene, proportioned to its extent, and agreeable to its character.

The choice of situations is also very free. A hermitage, indeed, must not be close to a road; but whether it be exposed to view on the side of a mountain, or concealed in the depth of a wood, is almost a matter of indifference; that it is at a distance from public resort is sufficient. A castle must not be sunk in a bottom; but that it should stand on the utmost pinnacle of a hill, is not necessary; on a lower knoll, and backed by the rise, it may appear to greater advantage as an object, and be much more important to the general composition. Many buildings, which from their splendour best become an open exposure, will yet be sometimes not ill bestowed on a more sequestered spot, either to characterize or adorn it; and others, for which a solitary would in general be preferred to an eminent situation, may occasionally be objects in very conspicuous positions. A Grecian temple, from its peculiar taste and dignity, deserves every distinction; it may, however, in the depth of a wood, be so circumstanced, that the want of those advantages to which it seems entitled will not be regretted. A happier situation cannot be devised, than that of the temple of Pan on the south lodge on Enfield Chase. It is of the usual oblong form, encompassed by a colonnade; in dimensions, and in style, it is equal to a most extensive landscape: and yet by the antique

Buildings.

antique and rustic air of its Doric columns without bases; by the chastity of its little ornaments, a crook, a pipe, and a scrip, and those only over the doors; and by the simplicity of the whole both within and without; it is adapted with so much propriety to the thickets which conceal it from the view, that no one can wish it to be brought forward, who is sensible to the charms of the Arcadian scene which this building alone has created. On the other hand, a very spacious field, or sheep walk, will not be disgraced by a farm house, a cottage, or a Dutch barn; nor will they, though small and familiar, appear to be inconsiderable or insignificant objects. Numberless other instances might be adduced to prove the impossibility of restraining particular buildings to particular situations, upon any general principles: the variety in their forms is hardly greater than in their application. Only let not their uses be disguised, as is often absurdly attempted with the humbler kinds. "A barn ‡ dressed up in the habit of a country church, or a farm house figuring away in the fierceness of a castle, are ridiculous deceptions. A landscape daubed upon a board, and a wooden steeple stuck up in a wood, are beneath contempt."

‡ Painting and Gardening, p. 3.

Temples, those favourite and most costly objects in gardens, too generally merit censure for their inutility, their profusion, or the impropriety of their purpose. "Whether they be dedicated to Bacchus, Venus, Priapus, or any other demon of debauchery, they are in this age, enlightened with regard to theological and scientific knowledge, equally absurd. Architecture, in this part of its sphere, may more nobly, and with greater beauty and effect, be exercised upon a chapel, a mausoleum, a monument, judiciously disposed among the natural ornaments. The late Sir William Harbord has given us a model, of the first kind, at Gunton, in Norfolk; the parish church standing in his park, and being an old unsightly building, he had it taken down, and a beautiful temple, under the direction of the Adams erected upon its site for the same sacred purpose:—The mausoleum at Castle-Howard, in Yorkshire, the seat of the earl of Carlisle, is a noble structure:—And as an instance of the last sort, may be mentioned the Temple of Concord and Victory at Stowe, erected to the memory of the great Lord Chatham and his glorious war; a beautiful monumental building, suited to the greatness of the occasion."

Ibid. 599

To the great variety above mentioned must be added, Mr Wheatley observes, the many changes which may be made by the means of ruins. They are a class by themselves, beautiful as objects, expressive as characters, and peculiarly calculated to connect with appendages into elegant groups. They may be accommodated with ease to irregularity of ground, and their disorder is improved by it. They may be intimately blended with trees and thickets; and the interruption is an advantage: for imperfection and obscurity are their properties, and to carry the imagination to something greater than is seen, is their effect. They may for any of these purposes be separated into detached pieces: contiguity is not necessary, nor even the appearance of it, if the relation be preserved; but straggling ruins have a bad effect, when the several parts are equally considerable. There should be one large mass to raise an idea of greatness, to attract the others about it, and to be a common centre of union to all: the smaller pieces then mark the original dimensions of one extensive structure; and no longer appear to be the remains of several little buildings.

Observations on Modern Gardening.

All remains excite an inquiry into the former state of the edifice, and fix the mind in a contemplation of the use it was applied to; besides the characters expressed by their style and position, they suggest ideas which would not arise from the buildings if entire. The purposes of many have ceased: an abbey, or a castle, if complete, can now be no more than a dwelling; the memory of the times, and of the manners to which they are adapted, is preserved only in history, and in ruins; and certain sensations of regret, of veneration, or compassion, attend the recollection. Nor are these confined to the remains of buildings which are in disuse; those of an old mansion raise reflections on the domestic comforts once enjoyed, and the ancient hospitality which reigned there. Whatever building we see in decay, we naturally contrast its present with its former state, and delight to ruminate on the comparison. It is true that such effects properly belong to real ruins: they are, however, produced in a certain degree by those which are fictitious: the impressions are not so strong, but they are exactly similar; and the representation, though it does not present facts to the memory, yet suggests subjects to the imagination. But, in order to affect the fancy, the supposed original design should be clear, the use obvious, and the form easy to be traced: no fragments should be hazarded without precise meaning, and an evident connexion; none should be perplexed in their construction, or uncertain as to their application. Conjectures about the form raise doubts about the existence of the ancient structure: the mind must not be allowed to hesitate; it must be hurried away from examining into the reality by the exactness and the force of the resemblance.

In the ruins of Tintern abbey ‖ the original construction of the church is perfectly marked; and it is principally from this circumstance that they are celebrated as a subject of curiosity and contemplation. The walls are almost entire; the roof only is fallen in, but most of the columns which divided the aisles are still standing: of those which have dropped down, the bases remain, every one exactly in its place; and in the middle of the nave four lofty arches, which once supported the steeple, rise high in the air above all the rest, each reduced now to a narrow rim of stone, but completely preserving its form. The shapes even of the windows are little altered; but some of them are quite obscured, others partially shaded, by tufts of ivy; and those which are most clear are edged with its slender tendrils, and lighter foliage, wreathing about the sides and the divisions: it winds round the pillars; it clings to the walls; and in one of the aisles clusters at the top in branches, so thick and so large as to darken the space below. The other aisles, and the great nave, are exposed to the sky: the floor is entirely overspread with turf; and to keep it clear from weeds and bushes, is now its highest preservation. Monkish tomb stones and the monuments of benefactors long since forgotten, appear above the green sward: the bases of the pillars which have fallen, rise out of it; and maimed effigies, and sculpture worn with age and weather, Gothic capitals, carved

‖ Between Chepstow and Monmouth.

cornices,

Art.

cornices and various fragments, are scattered about, or lie in heaps piled up together. Other shattered pieces, though disjointed and mouldering, still occupy their original places; and a staircase much impaired, which led to a tower now no more, is suspended at a great height, uncovered and inaccessible: nothing is perfect; but memorials of every part still subsist; all certain, but all in decay; and suggesting at once every idea which can occur in a seat of devotion, solitude, and desolation. Upon such models fictitious ruins should be formed; and if any parts are entirely lost, they should be such as the imagination can easily supply from those which are still remaining. Distinct traces of the building, which is supposed to have existed, are less liable to the suspicion of artifice, than an unmeaning heap of confusion. Precision is always satisfactory, but in the reality it is only agreeable; in the copy it is essential to the imitation.

A material circumstance to the truth of the imitation is, that the ruins appear to be very old. The idea is besides interesting in itself: a monument of antiquity is never seen with indifference; and a semblance of age may be given to the representation by the hue of the materials, the growth of ivy and other plants, and cracks and fragments seemingly occasioned rather by decay than by destruction. An appendage evidently more modern than the principal structure will sometimes corroborate the effect: the shed of a cottager amidst the remains of a temple, is a contrast both to the former and to the present state of the building; and a tree flourishing among ruins, shows the length of time they have lain neglected. No circumstance so forcibly marks the desolation of a spot once inhabited, as the prevalence of nature over it:

Campos ubi Troja fuit,

is a sentence which conveys a stronger idea of a city totally overthrown, than a description of its remains; but in a representation to the eye, some remains must appear; and then the perversion of them to an ordinary use, or an intermixture of a vigorous vegetation, intimates a settled despair of their restoration.

Sect. II. *Principles of Selection and Arrangement in the Subjects of Gardening.*

Planting and Gardening, p. 602.

I. Of ART. In the lower classes of rural improvements, art should be seen as little as may be; and in the more negligent scenes of nature, every thing ought to appear as if it had been done by the general laws of nature, or had grown out of a series of fortuitous circumstances. But in the higher departments, art cannot be hid; and the *appearance* of design ought not to be excluded. A human production cannot be made perfectly natural; and held out as such it becomes an imposition. Our art lies in endeavouring to adapt the productions of nature to human taste and perceptions; and if much art be used, do not *attempt* to hide it. Art seldom fails to please when executed in a masterly manner: nay, it is frequently the design and execution, more than the production itself, that strikes us. It is the artifice, not the design, which ought to be avoided. It is the labour and not the art which ought to be concealed. The rural artist ought, therefore, upon every occasion, to endeavour to avoid labour; or, if indispensably necessary, to conceal it. No trace should be left to lead back the mind to the expensive toil. A mound raised, a mountain levelled, or a useless temple built, convey to the mind feelings equally disgusting.

Picturesque Beauty & ...

II. PICTURESQUE BEAUTY. Though the aids of art are as essential to gardening, as education is to manners; yet art may do too much: she ought to be considered as the handmaid, not as the mistress, of nature; and whether she be employed in carving a tree into the figure of an animal, or in shaping a view into the form of a picture, she is equally culpable. The nature of the place is sacred. Should this tend to landscape, from some principal point of view, assist nature and perfect it; provided this can be done without injuring the views from other points. But do not disfigure the natural features of the place:—do not sacrifice its native beauties, to the arbitrary laws of landscape painting.

> Great Nature scorns controul; she will not bear
> One beauty foreign to the spot or soil
> She gives thee to adorn: 'Tis thine alone
> To mend, not change, her features. Mason.

Nature scarcely knows the thing mankind call a *landscape*. The landscape painter seldom, if ever, finds it perfected to his hands; some addition or alteration is almost always wanted. Every man who has made his observations upon natural scenery, knows that the misletoe of the oak occurs almost as often as a perfect natural landscape; and to attempt to make up artificial landscape upon every occasion is unnatural and absurd.

If, indeed, the eye were fixed in one point, the trees could be raised to their full height at command, and the sun be made to stand still, the rural artist might work by the rules of light and shade, and compose his landscape by the painter's law. But, whilst the sun continues to pour forth its light impartially, and the trees to rise with slow progression, it would be ridiculous to attempt it. Let him rather seek out, imitate, and associate, such striking passages in nature as are immediately applicable to the place to be improved, with regard to rules of landscape, merely human:—and let him,

> ————————in this and all
> Be various, wild, and free, as Nature's self. Mason.

Instead of sacrificing the natural beauties of the place to one formal landscape, let every step disclose fresh charms unsought for.

III. Of CHARACTER. Character is very reconcilable with beauty; and, even when independent of it, has attracted so much regard, as to occasion several frivolous attempts to produce it: statues, inscriptions, and even paintings, history and mythology, and a variety of devices, have been introduced for this purpose. The heathen deities and heroes have therefore had their several places assigned to them in the woods and lawns of a garden; natural cascades have been disfigured with river gods, and columns erected only to receive quotations; the compartiments of a summer

Character. mer house have been filled with pictures of gambols and revels, as significant of gaiety; the cypress, because it was once used in funerals, has been thought peculiarly adapted to melancholy; and the decorations, the furniture, and the environs of a building, have been crowded with puerilities under pretence of propriety. All these devices are rather *emblematical* than expressive: they may be ingenious contrivances, and recal absent ideas to the recollection; but they make no immediate impression: for they must be examined, compared, perhaps explained, before the whole design of them is well understood. And though an allusion to a favourite or well known subject of history, of poetry, or of tradition, may now and then animate or dignify a scene; yet as the subject does not naturally belong to a garden, the allusion should not be principal: it should seem to have been suggested by the scene; a transitory image, which irresistibly occurred; not sought for, not laboured; and have the force of a metaphor, free from the detail of an allegory.

Of imitative characters. Another species of character arises from direct *imitation;* when a scene or an object, which has been celebrated in description, or is familiar in idea, is represented in a garden. Artificial ruins, lakes, and rivers, fall under this denomination. The air of a seat extended to a distance, and scenes calculated to raise ideas of Arcadian elegance or of rural simplicity, with many more which have been occasionally mentioned, or will obviously occur, may be ranked in this class. They are all representations. But the materials, the dimensions, and other circumstances, being the same in the copy and the original, their effects are similar in both: and if not equally strong, the defect is not in the resemblance; but the consciousness of an imitation checks that train of thought which the appearance naturally suggests. Yet an over anxious solicitude to disguise the fallacy is often the means of exposing it: too many points of likeness sometimes hurt the deception; they seem studied and forced; and the affectation of resemblance destroys the supposition of a reality. A hermitage is the habitation of a recluse; it should be distinguished by its solitude, and its simplicity: but if it is filled with crucifixes, hour glasses, beads, and every other trinket which can be thought of, the attention is diverted from enjoying the retreat to examining the particulars: all the collateral circumstances which agree with a character seldom meet in one subject; and when they are industriously brought together, though each be natural, the collection is artificial.

Of original characters. But the art of gardening aspires to more than imitation: it can create *original* characters, and give expressions to the several scenes superior to any they can receive from allusions. Certain properties, and certain dispositions, of the objects of nature, are adapted to excite particular ideas and sensations; many of them have been occasionally mentioned, and all are very well known. They require no discernment, examination, or discussion; but are obvious at a glance, and instantaneously distinguished by our feelings. Beauty alone is not so engaging as this species of character: the impressions it makes are more transient and less interesting; for it aims only at delighting the eye, but the other affects our sensibility. An assemblage of the most elegant forms in the happiest situations is to a degree indiscriminate, if they have not been selected and arranged with a design to produce certain expressions; an air of magnificence, or of simplicity, of cheerfulness, tranquillity, or some other general character, ought to pervade the whole; and objects pleasing in themselves, if they contradict that character, should therefore be excluded: those which are only indifferent must sometimes make room for such as more significant; many will often be introduced for no other merit than their expression; and some, which are in general rather disagreeable, may occasionally be recommended by it. Barrenness itself may be an acceptable circumstance in a spot dedicated to solitude and melancholy.

The power of such characters is not confined to the ideas which the objects immediately suggest; for these are connected with others, which insensibly lead to subjects far distant perhaps from the original thought, and related to it only by a similitude in the sensations they excite. In a prospect enriched and enlivened with inhabitants and cultivation, the attention is caught at first by the circumstances which are gayest in their season, the bloom of an orchard, the festivity of a hay field, and the carols of harvest home; but the cheerfulness which these infuse into the mind, expands afterwards to other objects than those immediately presented to the eye; and we are thereby disposed to receive, and delighted to pursue, a variety of pleasing ideas, and every benevolent feeling. At the sight of a ruin, reflections on the change, the decay and the desolation before us, naturally occur; and they introduce a long succession of others all tinctured with that melancholy which these have inspired; or if the monument revive the memory of former times, we do not stop at the simple fact which it records, but recollect many more coeval circumstances, which we see, not perhaps as they were, but as they are come down to us, venerable with age, and magnified by fame. Even without the assistance of buildings or other adventitious circumstances, nature alone furnishes materials for scenes which may be adapted to almost every kind of expression: their operation is general, and their consequences are infinite: the mind is elevated, depressed, or composed, as gaiety, gloom, or tranquillity, prevails in the scene; and we soon lose sight of the means by which the character is formed; we forget the particular objects it presents; and giving way to their effects, without recurring to the cause, we follow the track they have begun, to any extent which the disposition they accord with will allow. It suffices that the scenes of nature have a power to affect our imagination and our sensibility; for such is the constitution of the human mind, that if once it is agitated, the emotion spreads far beyond the occasion: when the passions are roused, their course is unrestrained; when the fancy is on the wing, its flight is unbounded; and, quitting the inanimate objects which first gave them their spring, we may be led by thought above thought, widely differing in degree, but still corresponding in character, till we rise from familiar subjects up to the sublimest conceptions, and are wrapt in the contemplation of whatever is great or beautiful, which we see in nature, feel in man, or attribute to divinity.

General Arrangement.

IV. GENERAL ARRANGEMENT. Notwithstanding the nature of the place, as already observed, ought

Hunting-Box.

Practical Treatise on Planting and Gardening.

ought not to be sacrificed to the mansion;—the house must ever be allowed to be a principal in the composition. It ought to be considered as the centre of the system; and the rays of art, like those of the sun, should grow fainter as they recede from the centre. The house itself being entirely a work of art, its immediate environs should be highly finished; but as the distance increases, the appearance of design should gradually diminish, until nature and fortuitousness have full possession of the scene.

In general, the approach should be to the back front, which, in suitable situations, ought to lie open to the pasture grounds. On the sides more highly ornamented, a well kept gravel walk may embrace the walls; to this the shaven lawn and shrubbery succeed: next, the grounds closely pastured; and lastly, the surrounding country, which ought not to be considered as out of the artist's reach: for his art consists not more in decorating particular spots, than in endeavouring to render the whole face of nature delightful.

Another reason for this mode of arrangement is, objects immediately under the eye are seen more distinctly than those at a distance, and ought to be such as are pleasing in the detail. The beauties of a flower can be discerned on a near view only; whilst at a distance a roughet of coppice wood, and the most elegant arrangement of flowering shrubs, have the same effect. The most rational entertainment the human mind is capable of receiving, is that of observing the operations of nature. The foliation of a leaf, the blowing of flowers, and the maturation of fruits, are among the most delightful subjects that a contemplative mind can be employed in. These processes of nature are slow; and except the object fall spontaneously under the eye of the observer, the inconveniences of visiting it in a remote part, so far interfere with the more important employments of life, as to blunt, if not destroy, the enjoyment. This is a strong argument in favour of shrubs and flowers being planted under or near our windows, especially those from whence they may be viewed during the hours of leisure and tranquillity.

Ibid. p. 606.

Ornamented Cottage.

Further, the vegetable creation being subject to the animal, the shrub may be cropt, or the flower trodden down in its day of beauty. If therefore we wish to converse with nature in private, intruders must be kept off,—the shrubbery be severed from the ground;—yet not in such a manner as to drive away the pasturing stock from our sight. For this reason, the shaven lawn ought not to be too extensive, and the fence which incloses it should be such as will not interrupt the view: but whether it be seen or unseen, suspected or unsuspected, is a matter of no great import: its utility in protecting the shrubs and flowers,—in keeping the horns of the cattle from the window, and the feet of the sheep from the gravel and broken ground,—in preserving that neatness on the outside, which ought to correspond with the finishings and furniture within,—render it of sufficient importance to become even a part of the ornament.

PART II. EXECUTION OF THE GENERAL SUBJECTS.

IMPROVEMENTS in general may be classed under the following heads: The *Hunting-Box*, the *Ornamented Cottage*, the *Villa*, and the *Principal Residence*.

But before any step can be taken towards the execution of the design, be it large or small, a map or plan of the place, exactly as it lies in its unimproved state, should be made; with a corresponding sketch to mark the intended improvements upon. Not a hovel nor a twig should be touched, until the artist has studied maturely the natural abilities of the place, and has decidedly fixed in his mind, and finally settled on his plan, the proposed alterations: and even then, let him "dare with caution."

1. *Of Improvements adapted to a* Hunting-Box.

Here art has little to do. Hunting may be called the amusement of nature; and the place appropriated to it ought to be no farther altered from its natural state than decency and conveniency require:—With men who live in the present age of refinement, "a want of decency is a want of sense."

Ibid. p. 610, &c.

The style throughout should be *masculine*. If shrubs be required, they should be of the hardier sorts: the box, the holly, the laurustinus. The trees should be the oak and the beech, which give in autumn an agreeable variety of foliage, and anticipate as it were the season of diversion. A suite of paddocks should be seen from the house; and if a view of distant covers can be caught, the back-ground will be complete. The stable, the kennel, and the leaping-bar, are the factitious accompaniments; in the construction of which simplicity, substantialness, and conveniency, should prevail.

2. *Of the Style of an* Ornamented Cottage.

Neatness and simplicity ought to mark the style of this rational retreat. Ostentation and show should be cautiously avoided; even elegance should not be attempted; though it may not be hid, if it offer itself spontaneously.

Nothing, however, should appear vulgar, nor should simplicity be pared down to baldness; every thing whimsical or expensive ought to be studiously avoided;—chasteness and frugality should appear in every part.

Near the house a studied neatness may take place; but at a distance, negligence should rather be the characteristic.

If a taste for botany lead to a collection of native shrubs and flowers, a shrubbery will be requisite; but in this every thing should be native. A gaudy exotic ought not to be admitted; nor should the lawn be kept close shaven; its flowers should be permitted to blow; and the herbage, when mown, ought to be carried off, and applied to some useful purpose.

In the artificial accompanyments, ornament must be subordinate; utility must preside. The buildings, if any appear, should be those in actual use in rural economics. If the hovel be wanted, let it appear; and as a side-screen, the barn and rick-yard are admissible; whilst the

the dove-house and poultry-yard may enter more freely into the composition.

In fine, the ornamented cottage ought to exhibit cultivated nature in the first stage of refinement. It ranks next above the farm-house. The plain garb of rusticity may be set off to advantage; but the studied dress of the artist ought not to appear. That becoming neatness, and those domestic conveniences, which render the rural life agreeable to a cultivated mind, are all that should be aimed at.

3. *Of the Embellishment of a* Villa.

This demands a style very different from the preceding. It ought to be elegant, rich, or grand, according to the style of the house itself, and the state of the surrounding country; the principal business of the artist being to connect these two in such a manner, that the one shall not appear naked or flaring, nor the other desolate and inhospitable.

If the house be stately, and the adjacent country rich and highly cultivated, a shrubbery may intervene, in which art may show her utmost skill. Here the artist may even be permitted to play at landscape: for a place of this kind being supposed to be small, the purpose principally ornamental, and the point of view probably confined simply to the house, side-screens may be formed, and a fore-ground laid out suitable to the best distance that can be caught.

If buildings or other artificial ornaments abound in the offscope, so as to mark it strongly, they ought also to appear more or less in the fore-ground: if the distance abound with wood, the fore-ground should be thickened, lest baldness should offend; if open and naked, elegance rather than richness ought to be studied, lest heaviness should appear.

It is far from being any part of our plan to cavil unnecessarily at artists, whether living or dead; we cannot, however, refrain from expressing a concern for the almost total neglect of the principles here in ornamenting the vicinages of villas. It is to be regretted, that in the present practice these principles seem to be generally lost sight of. Without any regard to uniting the house with the adjacent country, and, indeed, seemingly without any regard whatever to the offscape, one invariable plan of embellishment prevails; namely, that of stripping the fore-ground entirely naked, or nearly so, and surrounding it with a wavy border of shrubs and a gravel walk; leaving the area, whether large or small, one naked sheet of green sward.

In small confined spots, this plan may be eligible. But a simple border round a large unbroken lawn only serves to show what more is wanted. Simplicity in general is pleasing; but even simplicity may be carried to an extreme, so as to convey no other idea than that of poverty and baldness. Besides, how often do we see in natural scenery, the holly and the fox-glove flourishing at the foot of an oak, and the primrose and the campion adding charms to the hawthorn scattered over the pastured lawn? And we conceive that single trees footed with evergreens and native flowers, and clumps as well as borders of shrubs, are admissible in ornamental as well as in natural scenery.

The species of shrub will vary with the purpose. If the principal intention be a winter retreat, evergreens and the early-blowing shrubs should predominate; but in a place to be frequented in summer and autumn, the deciduous tribes ought chiefly to be planted.

Principal Residence.

4. *Of the* Principal Residence.

Here the whole art centres. The artist has here full scope for a display of taste and genius. He has an extent of country under his eye, and will endeavour to make the most of what nature and accident have spread before him.

Round a principal residence, a gentleman may be supposed to have some considerable estate, and it is not a shrubbery and a ground only which fall under the consideration of the artist: he ought to endeavour to disclose to the view, either from the house or some other point, as much as he conveniently can of the adjacent estate. The love of possession is deeply planted in every man's breast: and places should bow to the gratification of their owners. To curtail the view by an artificial side-screen, or any other unnatural machinery, so as to deprive a man of the satisfaction of overlooking his own estate, is an absurdity which no artist ought to be permitted to be guilty of. It is very different, however, where the property of another intrudes upon the eye: Here the view may, with some colour of propriety, be bounded by a woody screen.

The grounds, however, by a proper management, may be made independent of whatever is external; and though prospects are nowhere more delightful than from a point of view which is also a beautiful spot, yet if in the environs of such a garden they should be wanting, the elegant, picturesque, and various scenes within itself, almost supply the deficiency.

Mr Wheatley's description of Stowe gardens.

"This (says Mr Wheatley) is the character of the gardens at Stowe: for there the views in the country are only circumstances subordinate to the scenes; and the principal advantage of the situation is the variety of the ground within the inclosure. The house stands on the brow of a gentle ascent: part of the gardens lie on the declivity, and spread over the bottom beyond it: this eminence is separated by a broad winding valley from another which is higher and steeper; and the descents of both are broken by large dips and hollows, sloping down the sides of the hills. The whole space is divided into a number of scenes, each distinguished with taste and fancy; and the changes are so frequent, so sudden, and complete, the transitions so artfully conducted, that the same ideas are never continued or repeated to satiety.

These gardens were begun when regularity was in fashion; and the original boundary is still preserved, on account of its magnificence: for round the whole circuit, of between three and four miles, is carried a very broad gravel walk, planted with rows of trees, and open either to the park or the country; a deep sunk fence attends it all the way, and comprehends a space of near 400 acres. But in the interior scenes of the garden, few traces of regularity appear; where it yet remains in the plantations, it is generally disguised: every symptom, almost, of formality, is obliterated from the ground; and an octagon bason in the bottom is now converted into an irregular piece of water, which receives on one hand two beautiful streams, and falls on the other down a cascade into a lake.

In the front of the house is a considerable lawn, open to

Principal Residence.

to the water: beyond which are two elegant Doric pavilions, placed in the boundary of the garden, but not marking it, though they correspond to each other; for still further back, on the brow of some rising grounds without the inclosure, stands a noble Corinthian arch, by which the principal approach is conducted, and from which all the gardens are seen, reclining back against their hills; they are rich with plantations; full of objects; and lying on both sides of the house almost equally, every part is within a moderate distance, notwithstanding the extent of the whole.

On the right of the lawn, but concealed from the house, is a perfect garden scene, called the *queen's amphitheatre*, where art is avowed, though formality is avoided. The fore-ground is scooped into a gentle hollow. The plantations on the sides, though but just rescued from regularity, yet in style are contrasted to each other: they are, on one hand, chiefly thickets, standing out from a wood; on the other, they are open groves, through which a glimpse of the water is visible. At the end of the hollow on a little knoll, quite detached from all appendages, is placed an open Ionic rotunda: beyond it, a large lawn slopes across the view; a pyramid stands on the brow; the queen's pillar, in a recess on the descent; and all the three buildings, being evidently intended for ornament alone, are peculiarly adapted to a garden-scene. Yet their number does not render it gay: the dusky hue of the pyramid, the retired situation of the queen's pillar, and the solitary appearance of the rotunda, give it an air of gravity; it is encompassed with wood; and all the external views are excluded; even the opening into the lawn is but an opening into an inclosure.

At the king's pillar, very near to this, is another lovely spot; which is small, but not confined; for no termination appears; the ground one way, the water another, retire under the trees out of sight, but nowhere meet with a boundary. The view is first over some very broken ground, thinly and irregularly planted; then between two beautiful clumps, which feather down to the bottom; and afterwards across a glade, and through a little grove beyond it, to that part of the lake where the thickets close upon the brink, spread a tranquillity over the surface, in which their shadows are reflected. Nothing is admitted to disturb that quiet: no building obtrudes; for objects to fix the eye are needless in a scene which may be comprehended at a glance; and none would suit the pastoral idea it inspires, of elegance too refined for a cottage, and of simplicity too pure for any other edifice.

The situation of the rotunda promises a prospect more enlarged; and in fact most of the objects on this side of the garden are there visible: but they want both connexion and contrast; each belongs peculiarly to some other spot: they are all blended together in this, without meaning; and are rather shown on a map, than formed into a picture. The water only is capital; a broad expanse of it is so near as to be seen under the little groups on the bank without interruption. Beyond it is a wood, which in one place leaves the lake, to run up behind a beautiful building, of three pavilions joined by arcades, all of the Ionic order: it is called *Kent's Building*. And never was a design more happily conceived: it seems to be characteristically proper for a garden; it is so elegant, so varied, and so purely ornamental: it directly fronts the rotunda, and a narrow rim of the country appears above the trees beyond it. But the effect even of this noble object is fainter here than at other points: its position is not the most advantageous; and it is but one among many other buildings, none of which are principal.

The scene at the temple of Bacchus is in character directly the reverse of that about the rotunda, though the space and the objects are nearly the same in both: but in this, all the parts concur to form one whole. The ground from every side shelves gradually towards the lake; the plantations on the further bank open to show Kent's building, rise from the water's edge towards the knoll on which it stands, and close again behind it. That elegant structure, inclined a little from a front view, becomes more beautiful by being thrown into perspective; and though at a greater distance, is more important than before, because it is alone in the view: for the queen's pillar and the rotunda are removed far aside; and every other circumstance refers to this interesting object: the water attracts, the ground and the plantations direct, the eye thither: and the country does not just glimmer in the offscape, but is close and eminent above the wood, and connected by clumps with the garden. The scene altogether is a most animated landscape; and the splendor of the building; the reflection in the lake; the transparency of the water, and picturesque beauty of its form, diversified by little groups on the brink, while on the broadest expanse no more trees cast their shadows than are sufficient to vary the tints of the surface; all these circumstances, vying in lustre with each other, and uniting in the point to which every part of the scene is related, diffuse a peculiar brilliancy over the whole composition.

The view from Kent's building is very different from those which have been hitherto described. They are all directed down the declivity of the lawn. This rises up the ascent: the eminence being crowned with lofty wood, becomes thereby more considerable; and the hillocks into which the general fall is broken, sloping further out this way than any other, they also acquire an importance which they had not before; that, particularly, on which the rotunda is placed, seems here to be a profound situation; and the structure appears to be properly adapted to so open an exposure. The temple of Bacchus, on the contrary, which commands such an illustrious view, is itself a retired object, close under the covert. The wood rising on the brow, and descending down one side of the hill, is shown to be deep; is high, and seems to be higher than it is. The lawn too is extensive; and part of the boundary being concealed, it suggests the idea of a still greater extent. A small portion only of the lake indeed is visible; but it is not here an object: it is a part of the spot; and neither termination being in sight, it has no diminutive appearance: if more water had been admitted, it might have hurt the character of the place, which is sober and temperate; neither solemn nor gay; great and simple, but elegant; above rusticity, yet free from ostentation.

These are the principal scenes on one side of the gardens. On the other, close to the lawn before the house, is

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is the winding valley above mentioned: the lower part of it is assigned to the Elysian fields. These are watered by a lovely rivulet; are very lightsome, and very airy, so thinly are the trees scattered about them; are open at one end to more water and a larger glade; and the rest of the boundary is frequently broken to let in objects afar off, which appear still more distant from the manner of showing them. The entrance is under a Doric arch, which coincides with an opening among the trees, and forms a kind of vista, through which a Pembroke bridge just below, and a lodge built like a castle in the park, are seen in a beautiful perspective. That bridge is at one extremity of the gardens; the queen's pillar is at another; yet both are visible from the same station in the Elysian fields: and all these external objects are unaffectedly introduced, divested of their own appurtenances, and combined with others which belong to the spot. The temple of Friendship is also in sight, just without the place; and within it are the temples of ancient Virtue, and of the British worthies; the one in an elevated situation, the other low down in the valley, and near to the water: both are decorated with the effigies of those who have been most distinguised for military, civil, or literary merit; and near to the former stands a rostral column, sacred to the memory of Captain Grenville, who fell in an action at sea: by placing here the meed of valour, and by filling these fields with the representations of those who have deserved best of mankind, the character intended to be given to the spot is justly and poetically expressed; and the number of the images which are presented or excited, perfectly corresponds with it. Solitude was never reckoned among the charms of Elysium; it has been always pictured as the mansion of delight and of joy: and in this imitation, every circumstance accords with that established idea. The vivacity of the stream which flows through the vale; the glimpses of another approaching to join it; the sprightly verdure of the green sward, and every bust of the British worthies reflected in the water; the variety of the trees; the lightness of the greens; their disposition; all of them distinct objects, and dispersed over gentle inequalities of the ground; together with the multiplicity of objects both within and without, which embellish and enliven the scene; give it a gaiety, which the imagination can hardly conceive, or the heart wish to be exceeded.

Close by this spot, and a perfect contrast to it, is the alder grove; a deep recess in the midst of a shade, which the blaze of noon cannot brighten. The water seems to be a stagnated pool, eating into its banks; and of a peculiar colour, not dirty but clouded, and dimly reflecting the dun hue of the horse-chesnuts and alders which press upon the brink: the stems of the latter, rising in clusters from the same root, bear one another down, and slant over the water. Mishapen elms and ragged firs are frequent in the wood which encompasses the hollow; the trunks of dead trees are left standing amongst them: and the uncouth sumach, and the yew, with elder, nut, and holly, compose the underwood: some limes and laurels are intermixed; but they are not many; the wood is in general of the darkest greens; and the foliage is thickened with ivy, which not only twines up the trees, but creeps also over the falls of the ground: these are steep and abrupt: the gravel-walk is covered with moss; and a grotto at the end, faced with broken flints and pebbles, preserves, in the simplicity of its materials, and the duskiness of its colour, all the character of its situation: two little rotundas near it were better away; one building is sufficient for such a scene of solitude as this, in which more circumstances of gloom concur than were perhaps ever collected together.

Immediately above the alder-grove is the principal eminence in the gardens. It is divided by a great dip into two pinnacles; upon one of which is a large Gothic building. The space before this structure is an extensive lawn: the ground on one side falls immediately into the dip; and the trees which border the lawn, sinking with the ground, the house rises above them, and fills the interval: the vast pile seems to be still larger than it is; for it is thrown into perspective, and between and above the heads of the trees, the upper story, the porticoes, the turrets, and ballustrades, and all the slated roofs, appear in a noble confusion. On the other side of the Gothic building, the ground slopes down a long continued declivity into a bottom, which seems to be perfectly irriguous. Divers streams wander about it in several directions: the conflux of that which runs from the Elysian fields with another below it, is full in sight; and a plain wooden bridge thrown over the latter, and evidently designed for a passage, imposes an air of reality on the river. Beyond it is one of the Doric porticoes which front the house; but now it is alone; it stands on a little bank above the water, and is seen under some trees at a distance before it; thus grouped, and thus accompanied, it is a happy incident, concurring with many other circumstances to distinguish this landscape by a character of cheerfulness and amenity.

From the Gothic building a broad walk leads to the Grecian valley, which is a scene of more grandeur than any in the gardens. It enters them from the park, spreading at first to a considerable breadth; then winds; grows narrower, but deeper; and loses itself at last in a thicket, behind some lofty elms, which interrupt the sight of the termination. Lovely woods and groves hang all the way on the declivities: and the open space is broken by detached trees; which, near the park, are cautiously and sparingly introduced, lest the breadth should be contracted by them; but as the valley sinks, they advance more boldly down the sides, stretch across or along the bottom, and cluster at times into groups and forms, which multiply the varieties of the larger plantations. Those are sometimes close coverts, and sometimes open groves: the trees rise in one upon high stems, and feather down to the bottom in another; and between them are short openings into the park or the gardens. In the midst of the scene, just at the bend of the valley, and commanding it on both sides, upon a large, easy, natural rise, is placed the temple of Concord and Victory: at one place its majestic front of six Ionic columns, supporting a pediment filled with bas relief, and the points of it crowned with statues, faces the view; at another, the beautiful colonnade, on the side, of 10 lofty pillars, retires in perspective. It is seen from every part; and impressing its own character of dignity on all around, in spreads an awe over the whole: but no gloom, no melancholy, attends it: the sensations it excites are rather

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ther placid; but full of respect, admiration, and solemnity: no water appears to enliven, no distant prospect to enrich the view; the parts of the scene are large, the idea of it sublime, and the execution happy; it is independent of all adventitious circumstances, and relies on itself for its greatness.

The scenes which have been described are such as are most remarkable for beauty or character; but the gardens contain many more; and even the objects in these, by their several combinations, produce very different effects, within the distance sometimes of a few paces, from the unevenness of the ground, the variety of the plantations, and the number of the buildings. The multiplicity of the last has indeed been often urged as an objection to Stowe; and certainly, when all are seen by a stranger in two or three hours, twenty or thirty capital structures, mixed with others of inferior note, do seem too many. But the growth of the wood every day weakens the objection, by concealing them one from the other: each belongs to a distinct scene; and if they are considered separately, at different times, and at leisure, it may be difficult to determine which to take away. Yet still it must be acknowledged that their frequency destroys all ideas of silence and retirement. Magnificence and splendor are the characteristics of Stowe: it is like one of those places celebrated in antiquity, which were devoted to the purposes of religion, and filled with sacred groves, hallowed fountains, and temples dedicated to several deities; the resort of distant nations, and the object of veneration to half the heathen world: this pomp is, at Stowe, blended with beauty; and the place is equally distinguished by its amenity and its grandeur.

In the midst of so much embellishment as may be introduced into this species of garden, a plain field, or a sheep-walk, is sometimes an agreeable relief, and even wilder scenes may occasionally be admitted. These indeed are not properly parts of a garden, but they may be comprehended within the verge of it; and the proximity to the more ornamented scenes is at least a convenience, that the transition from the one to the other may be easy, and the change always in our option. For though a spot in the highest state of improvement be a necessary appendage to a seat; yet, in a place which is perfect, other characters will not be wanting: if they cannot be had on a large scale, they are acceptable on a smaller; and so many circumstances are common to all, that they might often be intermixed; they may always border on each other."

Practical Treatise on Planting and Gardening, p. 615.

But on this head it would be in vain to attempt to lay down particular rules: different places are marked by sets of features as different from each other as are those in men's faces. Much must be left to the skill and taste of the artist; and let those be what they may, nothing but mature study of the natural abilities of the particular place to be improved can render him equal to the execution, so as to make the most of the materials that are placed before him.

Some few general rules may nevertheless be laid down. The approach ought to be conducted in such a manner, that the striking features of the place shall burst upon the view at once: no trick however should be made use of: all should appear to fall in naturally. In leading towards the house, its direction should not be fully in front, not exactly at an angle, but should pass obliquely upon the house and its accompaniments; so that their position with respect to each other, as well as the perspective appearance of the house itself, may vary at every step: and having shown the front and the principal wing, or other accompaniment, to advantage, the approach should wind to the back front, which, as has been already observed, ought to lie open to the park or pastured grounds.

The improvements and the rooms from which they are to be seen should be in unison. Thus, the view from the drawing-room should be highly embellished, to correspond with the beauty and elegance within: every thing here should be feminine, elegant, beautiful, such as attunes the mind to politeness and lively conversation. The breakfasting room should have more masculine objects in view: wood, water, and an extended country for the eye to roam over; such as allures us imperceptibly to the ride or the chase. The eating and banqueting rooms need no exterior allurements.

There is a harmony in taste as in music: variety, and even wildness upon some occasions, may be admitted; but discord cannot be allowed. If, therefore, a place be so circumstanced as to consist of properties totally irreconcileable, the parts ought, if possible, to be separated in such a manner, that, like the air and the recitative, the adagio and the allegro, in music, they may set off each other's charms by the contrast.—These observations, in the elegant performance whence they are extracted, the author illustrates by the following description and proposed improvement of Persefield, the seat of Mr Morris, near Chepstow in Monmouthshire; a place upon which nature has been peculiarly lavish of her favours, and which has been spoken of by Mr Wheatley, Mr Gilpin, and other writers, in the most flattering terms.

Description of Persefield, ib. p. 61[illegible].

"Persefield is situated upon the banks of the river Wye, which divides Gloucestershire and Monmouthshire, and which was formerly the boundary between England and Wales. The general tendency of the river is from north to south; but about Persefield it describes by its winding course the letter S, somewhat compressed, so as to reduce it in length and increase its width. The grounds of Persefield are lifted high above the bed of the river, shelving, and form the brink of a lofty and steep precipice, towards the southwest.

"The lower limb of the letter is filled with Persewood, which makes a part of Persefield; but it is at present an impenetrable thicket of coppice-wood. This dips to the south-east down to the water's edge; and, seen from the top of the opposite rock, has a good effect.

"The upper limb receives the farms of Llancot, rich and highly cultivated, broken into inclosures, and scattered with groups and single trees; two well-looking farm-houses in the centre, and a neat white chapel on one side: altogether a lovely little paradisaical spot. The lowliness of its situation stamps it with an air of meekness and humility; and the natural barriers which surround it add that of peacefulness and security. The picturesque farms do not form a low flat bottom, subject to be overflowed by the river; but take the form of a gorget, rising fullest in the middle, and falling on every side gently to the brink of the Wye; except

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except on the east side, where the top of the gorget leans in an easy manner against a range of perpendicular rock; as if to show its disk with advantage to the walks of Persefield.

"This rock stretches across what may be called the *Isthmus*, leaving only a narrow pass down into the fields of Llancot, and joins the principal range of rocks at the lower bend of the river.

"To the north, at the head of the latter, stands an immense rock (or rather a pile of immense rocks heaped one above another) called *Windcliff;* the top of which is elevated as much above the grounds of Persefield as those are above the fields of Llancot.

"These several rocks, with the wooded precipices on the side of Persefield, form a circular inclosure, about a mile in diameter, including Perse-wood, Llancot, the Wye, and a small meadow lying at the foot of Windcliff.

"The grounds are divided into the upper and lower lawn, by the approach to the house: a small irregular building, standing near the brink of the precipice, but facing down the lower lawn, a beautiful ground, falling 'precipitately every way into a valley which shelves down in the middle,' and is scattered with groups and single trees in an excellent style.

"The view from the house is soft, rich, and beautifully picturesque; the lawn and woods of Persefield and the opposite banks of the river; the Wye, near its mouth, winding through 'meadows green as emerald,' in a manner peculiarly graceful; the Severn, here very broad, backed by the wooded and highly cultivated hills of Gloucestershire, Wiltshire, and Somersetshire. Not one rock enters into the composition. The whole view consists of an elegant arrangement of lawn, wood, and water.

"The upper lawn is a less beautiful ground, and the view from it, though it command the 'cultivated hills and rich valleys of Monmouthshire,' bounded by the Severn and backed by the Mendip-hills, is much inferior to that from the house.

"To give variety to the views from Persefield, to disclose the native grandeur, which surrounds it, and to set off its more striking features to advantage, walks have been cut through the woods and on the face of the precipice which border the grounds to the south and east. The viewer enters these walks at the lower corner of the lower lawn.

"The first point of view is marked by an alcove, from which are seen the bridge and the town of Chepstow, with its castle situated in a remarkable manner on the very brink of a perpendicular rock, washed by the Wye; and beyond these the Severn shows a small portion of its silvery surface.

"Proceeding a little farther along the walk, a view is caught which the painter might call a complete landscape: The castle, with the serpentine part of the Wye below Chepstow, intermixed in a peculiar manner with the broad waters of the Severn, forms the fore-ground; which is backed by distant hills: the rocks, crowned with wood, lying between the alcove and the castle, to the right, and Castlehill farm, elevated upon the opposite banks of the river, to the left, form the two side-screens. This point is not marked, and must frequently be lost to the stranger.

"The grotto, situated at the head of Perse-wood, commands a near view of the opposite rocks; magnificent beyond description! The littleness of human art was never placed in a more humiliating point of view; the castle of Chepstow, a noble fortress, is, compared with the natural bulwarks, a mere house of cards.

"Above the grotto, upon the isthmus of the Persefield side, is a shrubbery; strangely misplaced! an unpardonable intrusion upon the native grandeur of this scene. Mr Gilpin's observations upon this, as upon every other occasion, are very just. He says, 'It is a pity the ingenious embellisher of these scenes could not have been satisfied with the great beauties of nature which he commanded. The shrubberies he has introduced in this part of his improvements I fear will rather be esteemed paltry.'——'It is not the shrub which offends; it is the formal introduction of it. Wild underwood may be an appendage of the grandest scene; it is a beautiful appendage. A bed of violets or of lilies may enamel the ground with propriety at the foot of an oak; but if you introduce them artificially in a border, you introduce a trifling formality, and disgrace the noble object you wish to adorn.'

"The walk now leaves the wood, and opens upon the lower lawn, until coming near the house it enters the alarming precipice facing Llancot; winding along the face of it in a manner which does great honour to the artist. Sometimes the fragments of rock which fall in its way are avoided, at other times partially removed, so as to conduct the path along a ledge carved out of the rock; and in one instance, a huge fragment, of a somewhat conical shape and many yards high, is perforated; the path leading through its base. This is a thought which will hand down to future times the greatness of Mr Morris's taste; the design and the execution are equally great; not a mark of a tool to be seen; all appears perfectly natural. The arch-way is made winding, so that on the approach it appears to be the mouth of a cave; and, on a nearer view, the idea is strengthened by an allowable deception; a black dark hole on the side next the cliff, which, seen from the entrance before the perforation is discovered, appears to be the darksome inlet into the body of the cave.

From this point, that vast inclosure of rocks and precipices which marks the peculiar magnificence of Persefield is seen to advantage. The area, containing in this point of view the fields of Llancot and the lower margin of Perse-wood, is broken in a manner peculiarly picturesque by the graceful winding of the Wye; here washing a low grassy shore, and there sweeping at the feet of the rocks which rise in some places perpendicular from the water; but in general they have a wooded offset at the base; above which they rise to one, two, or perhaps three or four hundred feet high; exposing one full face, silvered by age, and bearded with ivy, growing out of the wrinkle-like seams and fissures. If one might be allowed to compare the paltry performances of art with the magnificent works of nature, we should say, that this inclosure resembles a prodigious fortress which has long lain in ruins. It is in reality one of nature's strong-holds; and as such has probably been frequently made use of. Across the isthmus on the Gloucestershire side there are the remains of a deep intrenchment, called to this day the *Bulwark;*

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Bulwark; and tradition still teems with the extraordinary warlike feats that have been performed among this romantic scenery.

"From the perforated rock, the walk leads down to the cold-bath (a complete place), seated about the mid-way of the precipice, in this part less steep; and from the cold-bath a rough path winds down to the meadow, by the side of the Wye, from whence the precipice on the Persefield side is seen with every advantage; the giant fragments, hung with shrubs and ivy, rise in a ghastly manner from amongst the underwood, and show themselves in all their native savageness.

"From the cold-bath upward, a coach-road (very steep and difficult) leads to the top of the cliff, at the upper corner of the upper lawn. Near the top of the road is a point which commands one of the most pleasing views of Persefield: The Wye sweeping through a grassy vale which opens to the left:—Llancot backed by its rocks, with the Severn immediately behind them; and, seen in this point of view, seems to be divided from the Wye by only a sharp ridge of rock, with a precipice on either side; and behind the Severn, the vale and wooded hills of Gloucestershire.

"From this place a road leads to the top of Windcliff—astonishing sight! The face of nature probably affords not a more magnificent scene! Llancot in all its grandeur, the ground of Persefield, the castle and town of Chepstow, the graceful windings of the Wye below, and its conflux with the Severn; to the left the forest of Dean; to the right, the rich marshes and picturesque mountains of South Wales; a broad view of the Severn, opening its sea-like mouth; the conflux of the Avon, with merchant ships at anchor in King-road, and vessels of different descriptions under sail; Aust-Cliff, and the whole vale of Berkeley, backed by the wooded swells of Gloucestershire, the view terminating in clouds of distant hills, rising one behind another, until the eye becomes unable to distinguish the earth's billowy surface from the clouds themselves."

The leading principle of the improvement proposed by our author is, to, "separate the sublime from the beautiful; so that in viewing the one, the eye might not so much as suspect that the other was near.

"Let the hanging walk be conducted entirely along the precipices, or through the thickets, so as to disclose the natural scenery, without once discovering the lawn or any other acquired softness. Let the path be as rude as if trodden only by wild beasts and savages, and the resting places, if any, as rustic as possible.

"Erase entirely the present shrubbery, and lay out another as elegant as nature and art could render it before the house, swelling it out into the lawn towards the stables; between which and the kitchen-garden make a narrow winding entrance.

"Convert the upper lawn into a deer-paddock, suffering it to run as wild, rough, and forest-like, as total negligence would render it.

"The viewer would then be thus conducted: He would enter the hanging-walk by a sequestrated path at the lower corner of the lawn, pursuing it through the wood to beneath the grotto, and round the head-land, or winding through Perse-wood, to the perforated rock and the cold-bath, without once conceiving an idea (if possible) that art, or at least that much art, had been made use of in disclosing the natural grandeur of the surrounding objects; which ought to appear as if they presented themselves to his view, or at most as if nothing was wanted but his own penetration and judgement to find them out. The walk should therefore be conducted in such a manner, that the breaks might be quite natural; yet the points of view obvious, or requiring nothing but a block or stone to mark them. A stranger at least wants no seat here; he is too eager in the early part of his walk, to think of lounging upon a bench.

"From the cold bath he would ascend the steep, near the top of which a commodious bench or benches might be placed: the fatigue of ascending the hill would require a resting place; and there are few points which afford a more pleasing view than this; it is grand, without being too broad and glaring.

"From these branches he would enter the forest part. Here the idea of Nature in her primitive state would be strengthened: the roughnesses and deer to the right, and the rocks in all their native wilduess to the left. Even Llancot might be shut out from the view by the natural shrubbery of the cliff. The Lover's Leap, however (a tremendous peep), might remain; but no benches, nor other work of art, should here be seen. A natural path, deviating near the brink of the precipice, would bring the viewer down to the lower corner of the park; where benches should be placed in a happy point, so as to give a full view of the rocks and native wildnesses, and at the same time hide the farm houses, fields, and other acquired beauties of Llancot.

"Having satiated himself with this savage scene, he would be led, by a still rustic path, through the labyrinth—when the shrubbery, the lawn, with all its appendages, the graceful Wye, and the broad silver Severn, would break upon the eye with every advantage of ornamental nature: the transition could not fail to strike.

"From this soft scene he would be shown to the top of Windcliff, where in one vast view he would unite the sublime and beautiful of Persefield."

Only one particular remains now to be noticed. A place which is the residence of a family all the year is very defective, if some portion of it be not set apart for the enjoyment of a fine day, for air, and exercise, in winter. To such a spot shelter is absolutely essential; and evergreens being the thickest covert, are therefore the best; their verdure also is then agreeable to the eye; and they may be arrauged so as to produce beautiful mixture of greens, with more certainty than deciduous trees, and with almost equal variety: they may be collected into a wood; and through that wood gravel-walks may be led along openings of a considerable breadth, free from large trees which would intercept the rays of the sun, and winding in such a manner as to avoid any draft of wind, from whatever quarter it may blow. But when a retreat at all times is thus secured, other spots may be adapted only to occasional purposes; and be sheltered towards the north or the east on one hand, while they are open to the sun on the other. The few hours of cheerfulness and warmth which its beams afford are so valuable as to justify the sacrifice even of the principles of beauty to the enjoyment of them; and therefore no objections

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PART III. PRACTICAL GARDENING.

WE now proceed to treat of horticulture or practical gardening. And although it may not appear to be the most perfect arrangement; yet as it is probably the most convenient and useful in the directions to be given for the practical management of the garden, we shall consider the work to be done for each month of the year in the kitchen garden, the fruit garden, the flower garden and the nursery, under so many separate sections.

JANUARY.

SECT. I. *Kitchen Garden.*

Sowing radishes. IN the beginning, or any time in the course of this month, when the weather is open, sow some short-top'd radishes on a border exposed to the south, and protected by a wall or other fence; and about the middle or latter end of the month, you may sow some more of the same sort, and also some salmon radishes to succeed the short-top'd. The seed should be sown pretty thick at this season, because vegetation being slow at this period they will be longer exposed to the depredation of birds, and if the weather prove severe, many of them will be cut off after they have appeared above ground. Sow the seed evenly over the surface, and rake it in with a large wide-toothed rake, or if sown in beds, cover it with earth to the depth of half an inch from the alleys. A covering of straw about two inches thick would greatly promote their growth, and protect them from frost and birds. After the plants have come above ground, the covering of straw should be drawn off with a light rake in the early part of the day, and replaced in the evening.

Garden mats are frequently used to cover radishes, a number of small pins being previously stuck into the ground to support them an inch or two from the surface, and prevent them from pressing down the young plants. The covering ought to be continued for a longer or shorter time, according to the severity of the weather; but when the plants have pushed out their rough leaves it may safely be discontinued. Radishes sown under common hot-bed frames, without the assistance of warm dung, will succeed very well, and come on much earlier than those sown in the open air: due attention, however, must be paid to give them air whenever the weather is mild, by raising the glasses, or removing them altogether during warm days. If wanted very early, recourse must be had to a slight hot-bed.

At any time in this month, when the weather is mild and dry, let a spot of ground in a warm situation be prepared for sowing a few early carrots, by digging the ground a full spade deep, and breaking the earth well; and when the seed is sown, let it be raked in. When carrots are wanted very early, they may be reared in a slight hot-bed. 18 Carrots.

About the beginning, or any time in the month, when the weather is mild, you may sow some spinach; but if the weather will permit, some ought to be sown, both in the beginning and towards the end of the month. The smooth-seeded or round-leaved spinach should chiefly be sown now. It is preferred, on account of its leaves being thicker, larger, and more succulent than the prickly-seeded; though some of the latter ought also to be sown, because it is hardier, and better able to sustain the severity of the weather. They may be sown either broadcast and raked in, or in shallow drills about an inch deep, and nine or ten inches asunder. It is a frequent practice to sow spinach in drills between the rows of early beans and cabbages. 19 Spinach.

You may sow some seed of cress, mustard, radish, rape, &c. and likewise some lap lettuce in a warm situation exposed to the sun. They form an agreeable salad when cut young. The ground on which they are to be sown ought to be sloped to the south, and covered with a common hot-bed frame, which should be sunk in the ground, so far as to allow the glasses to approach to within six or eight inches of the sown surface. 20 Small salad.

But small salad will succeed best in a slight hot-bed of warm dung formed to the depth of 18 or 20 inches; air must be admitted freely, whenever the weather will permit, by raising or removing the glasses.

About the middle, or towards the latter end of the month, sow parsley seed in any dry situation, in shallow drills nine inches asunder, and cover it in with earth to the depth of a quarter of an inch, or in single rows along the borders of the kitchen garden. There are two sorts, the plain-leaved and curled-leaved; the latter is preferred as garnishing on account of its large bushy leaves, 21 Parsley.

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leaves, but both are equally good as pot herbs. This seed lies very long in the ground before it vegetates.

22 Peas. Sow some early peas in a warm situation, to succeed those sown in November and December. The principal early peas are the Charlton hotspur, golden hotspur, Reading hotspur, Masters hotspur, &c. the two first of which are reckoned the earliest. Sow them in rows two feet and a half asunder, but when they are to be supported by sticks they ought to be three feet asunder. Some marrowfat peas should likewise be sown at this season for a first crop of late peas: the dwarf marrowfat is the most proper, but any other late pea will succeed very well, such as the Spanish moratto, tall marrowfat, Prussian prolific, sugar pea, dwarf sugar, egg pea, pearl pea, &c. These should be sown in rows three feet asunder; but when it is intended that they should be supported by sticks, the rows should be three feet and a half apart.

23 Beans. Any time in the course of the month, if the weather be mild, a main crop of beans may be sown. The Sandwich bean, toker, Windsor, broad Spanish, broad long-pod, &c. are the kinds most commonly used. After the ground has been well dug, put in the beans to the depth of about two inches, with a dibble, in rows three feet apart, and at the distance of four or five inches from each other in the rows: or they may be sown in drills to the same depth and distance. If no early beans were sown in November or December, they ought to be sown the earliest opportunity this month: the early Mazagan and Lisbon beans are the best. They ought to be planted in a warm border; if at the foot of a south wall, they will come on earlier. These may be planted closer than the larger beans, two feet, or two feet and a half, between the rows, being sufficient. When peas or beans are wanted very early, they may be sown in hot-beds or stoves, and when somewhat advanced, they may either be planted out into other hot-beds, into peach and vine-houses, or into any warm situation in the open air.

24 Lettuce. In the beginning, and again towards the end of the month, you may sow some lettuce. The kinds commonly used are the green and white cos, brown Dutch, Cilicia, and common cabbage lettuce. Prepare a piece of ground in a warm situation; sow the seeds moderately thick, and rake them in as evenly as possible. They may also be sown under hand glasses or in common hot-bed frames, to be occasionally covered with glasses or mats: but in either case, air must be freely admitted, whenever the weather will permit. When wished for very early, they may be sown in a slight hot-bed, and planted out in the open air in March or April.

Take care of lettuce plants which have stood the winter.—If you have lettuce plants in frames or under hoops, covered with mats, give them plenty of air when the weather is moderate. Remove all decayed leaves, and destroy snails which frequently infest them; and when the frost is severe, take care to protect them well with mats.

25 Examine cauliflower plants. The cauliflower plants raised last autumn, which have stood during the winter in frames, should be looked over in open weather. If any decayed leaves appear, pick them off; stir up the earth between the plants, and remove all weeds. In mild weather, give them plenty of air during the day, by pushing down, or removing the glasses altogether: but cover them during the night, unless when the weather is particularly mild: when it is frosty, or rains much, they ought to be covered during the day. But if the frost is very severe, the frames should be protected at night with a covering of mats, and even during the day, should the frost be intense, without sunshine; and some straw, dried leaves, or something of that nature, should likewise be laid all round the outside of the frame, to prevent the frost from penetrating its sides.

Cauliflowers under bell and hand glasses require the same attention: during mild weather, the covers should either be taken off altogether, or raised (or tilted) on the south side, so as to admit the air freely during the day, and shut again at night, unless the weather should be very mild, in which case they may remain a little tilted on one side; but should intense frost prevail, they should be kept shut, and covered with straw or something of that nature. The free admission of the air will prevent the plants from becoming weak, and make them less apt to run up to flower before they have acquired sufficient size. In mild winters, slugs very frequently injure cauliflower plants; they ought, therefore, to be carefully looked for and destroyed.

26 Plant cabbages. About the end of the month, if the weather is mild, plant out a few early cabbages, on a spot of ground well dug and manured with rotten dung, at the distance of a foot and a half from each other, or even closer, as they are to be cut early, and before they acquire a great size. The early York, Battersea, and sugar-loaf, are the kinds which should be planted at this season.

27 Transplant cabbages, &c. for seed. Transplant some full grown cabbages and savoys, for seed, about the beginning of the month; though the early part of winter is the most proper time for doing so. See NOVEMBER.

28 Earth celery. In open dry weather, earth up such celery as has advanced much above ground; let the earth be well broken, and laid up almost to the tops of the plants, but care must be taken not to bruise them. This will afford them protection against frost, which might prove very injurious to them at this season.

Where celery is wanted daily, a quantity of straw or something of that nature, should be laid over the rows on the approach of frost, which will prevent the frost from penetrating the ground, and on the removal of the covering, the celery may be dug up: or when severe weather threatens to set in, a quantity of celery may be taken up, placed in some situation sheltered from the weather, and covered as far as the blanched part extends with sand.

29 Blanch endive. In open dry weather prepare some full grown endive for blanching. When the plants are perfectly dry tie up their leaves close together, and they will be completely blanched in about a fortnight. As endive is very apt to rot in wet weather at this season, when blanched in the open air, a quantity of it ought to be transplanted into a ridge of dry earth, in some situation where it may be sheltered from rain.

30 Earth peas and beans. In open dry weather, the earth should be drawn up about such peas and beans as may have advanced an inch or two above ground, which will both strengthen them and protect them against frost.

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Artichokes. Management of mushroom beds.

If artichokes have not been earthed up before this, that work should now be done the first opportunity. See NOVEMBER.

Mushroom beds ought to be well covered at this season, and protected both from rain and frost. The covering of straw should at least be a foot thick, and if the rain should at any time have penetrated nearly through it, it ought to be removed, and a covering of dry straw put in its place; for if the bed should get wet, the spawn would be injured, and the future crop destroyed.

Sometimes it is desirable to have some of the ordinary kitchen garden crops, at an earlier period, than that at which they are produced in the open air. For this purpose recourse is had to hot-beds; there are likewise some things reared in the kitchen garden, such as cucumbers and melons, which cannot be obtained in this country without their aid. The principal crops, besides cucumbers and melons, for which hot-beds may be prepared in this month, are asparagus, small salad, mint, tansey, peas and beans for transplanting, radishes, early carrots, early potatoes, and kidney beans. Hot-beds are formed either of fresh horse dung, or of tanners bark; the hot-beds used this month, as seed beds for early cucumbers and melons, are almost always formed of horse dung. Procure a sufficient quantity of fresh horse dung, according to the size and number of the hot-beds you mean to form, lay it up in a heap to ferment for ten or twelve days, longer or shorter according to the condition of the dung or the state of the weather, during which time it ought to be turned over once or twice with a fork, that it may be thoroughly mixed and equally fermented. After the violent fermentation is over, and the rank steam has escaped, it will be in proper condition to form a hot-bed. Dung that is very much mixed with straw, or is too dry, ought to be rejected. About a cart-load may be sufficient for a common hot-bed frame of one light, and so on in proportion for one of two or three lights. Hot-beds should be formed in a situation sheltered from the wind, and exposed to the morning or mid-day sun. Some dig a trench about a foot deep, and a few inches longer and wider than the frame with which they mean to cover the bed; others form hot-beds on the surface of the ground. At this season of the year the last mode is to be preferred, because it affords an opportunity of lining the bed with fresh hot dung quite down to the bottom, to augment the heat when it declines; in this way water is likewise prevented from settling about the bottom of the bed, which is often the case, when the bed is formed in a trench, which would inevitably check the fermentation, and consequently destroy the heat of the bed. Mark out a space on the ground, a few inches longer and wider than the frame which you intend to put on the bed. Spread the dung when in proper condition, regularly with a fork, beating it down gently from time to time with the fork; when the dung is trodden down, it is apt to heat too violently, and does not succeed so well as when the dung is allowed to settle gradually. The dung ought to be raised to three feet and a half or thereabouts. In this way hot beds may be formed, which will preserve their heat for a considerable time: When slighter hot-beds are required, the dung may be raised to one foot and a half, or two feet: those slight hot-beds answer very well for raising early crops.

33 Sow cucumber and melon seeds.

Having prepared a hot-bed according to the directions just given for a larger or smaller frame, in proportion to the quantity of seed you intend to sow, such a one as may be covered with a frame of one light will be sufficient to raise plants for an ordinary crop. Let the frame and lights be put on, and kept close, till the heat begin to rise, then raise the glass, that the steam may pass off. Three or four days after the bed has been formed, it may be covered with earth prepared for that purpose, to the depth of about three inches; before the earth is put on, if the dung shall have settled unequally, the surface of the bed ought to be made perfectly level. Rich light dry earth is best adapted to this purpose: that it may be dry enough, it ought to have been protected from the rain by some shade during the winter; for, should it be wet, it is apt to prevent the seeds from germinating, or to injure the young plants. Fill two or three small flower-pots with some of the same earth, and place them in the hot-bed till the earth in them be warmed, and then sow the seeds.

Sow the seeds, and cover them about half an inch deep; the bottom of the pots ought to be plunged a little way into the earth with which the bed is covered, some of which ought to be drawn up round the pots. A few days after sowing the seeds in the pots, some seeds may be sown in the earth of the bed. By sowing in pots, if the bed should overheat (which is sometimes the case) you have it in your power to withdraw and remove the pots out of danger.

After sowing the seeds, put on the lights; when the steam rises copiously, give the hot-bed air by raising the glasses a little. The hot-bed ought to be covered every evening about sunset with mats, which should be taken off again in the morning about nine o'clock, sooner or later according to the state of the weather. A single mat will be sufficient at first, as the warmth of the bed will be strong. The ends of the mats ought not to hang down over the sides of the frame, because the rank steam proceeding from the bed would be confined, and might injure the plants. The plants will appear, in two or three days after the seeds have been sown, when care must be taken to raise the glasses a little to admit fresh air, and to allow the steam of the bed to escape; if this be not properly attended to, and if the beds be kept too close, the plants will either be destroyed altogether, or become weak and yellowish. About the time the first sown seeds appear above ground, a few more ought to be sown in the earth of the bed. As those tender plants are liable to suffer from various causes at this season, it would be proper to sow a little seed at three different periods, at short intervals, that if one sowing should miscarry, another may succeed. Three or four days after the plants have come up, they ought to be planted out into small pots.

The day before the plants are to be transplanted, pots filled with light rich dry earth should be put into the bed, that the earth which they contain may be brought to a proper temperature. Take the plants carefully up, raising them with your finger and thumb, with all the roots as entire as possible, and with as much of the earth as will readily adhere about the fibres. Plant three cucumbers and two melons in each pot, and draw the earth well up about the stems. If the earth in the pots be very dry, a little water should be given

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given after the transplanting has been finished. The pots ought to be plunged close to one another in the earth of the bed, and all the spaces between them ought to be carefully filled with earth, to prevent the rank steam of the dung from rising up, which would certainly kill the plants. The bed ought to be carefully examined every day, to see that the roots of the plants do not receive too much heat. If any thing like that appear, draw up the pots a little, taking care to replunge them to the rim after the danger is over. When the plants are fairly rooted, if the earth appears dry, give them a little water in the warmest time of the day; let the watering be occasionally repeated very moderately, according as the earth in the pots becomes dry. All the water given to the plants at this season ought to stand for a few hours within the bed, that it may acquire the same temperature with the earth in which the plants grow, as very cold water would chill the plants too much. In order to preserve a proper heat in the bed as long as possible, the sides of it ought to be covered with straw or dry leaves, which will defend the bed from cold piercing winds, heavy rains, and snow. Should the bed be unprotected when any of these prevail, the heat would be diminished, and the plants receive a check. If a lively heat be kept up, you may admit air to the plants every day, by raising the glasses in proportion to the heat of the bed and temperature of the external air. If the air be very cold, it will be necessary to fix a piece of mat or some such thing to the edge of the sash, which may hang down over the opening, and prevent the cold air from rushing too freely into the bed. About a fortnight after the bed has been formed, it ought to be examined carefully, to discover whether the heat of the bed still continues strong enough; if not, the dry leaves and straw ought to be removed from the front and back of the bed if any had been placed there, and a quantity of fresh horse dung should be supplied. The lining thus applied should not exceed 15 or 18 inches in thickness, and should be raised a few inches higher than the bed. When too thick a lining is applied, it is apt to throw in too great a heat, and injure the plants. A quantity of earth should be laid on the top of the dung thus applied to the depth of two inches, to keep down the rank steam. The lining will soon increase the heat of the bed, and maintain it for ten days or a fortnight longer. At the expiration of that time, when the heat begins to fail, the two sides of the bed should receive a lining of the same thickness, which will again augment the heat of the bed, and preserve it in good condition for upwards of a fortnight longer. By lining first the one side and then the other at the interval of about a week or ten days, the heat of the bed may be made to last longer than when both linings are applied at the same time. Either method may be followed, according to the degree of external cold which may prevail, or according to the degree of warmth required to be maintained in the bed. After performing the lining, if very cold, wet, or snowy weather prevail, it may be proper to lay a quantity of long dry litter all round the general lining, which will protect the whole of the bed, and keep it in a proper temperature. By the proper management of this seed-bed, and by the due application of linings, the growth of young plants may be promoted till they are fit to be planted out into other hot-beds, where they are to remain and produce fruit. Where there is plenty of hot dung and every other convenience, a second bed may be prepared, into which the young plants may be transferred and nursed till they become perfectly fit for final transplantation. Due attention must be paid to have this second nursery-bed in proper condition for the reception of the pots containing the young plants. It is to be formed, earthed over, and taken care of, according to the directions given for the management of the seed-bed. When the plants have got their two first rough leaves, two or three inches broad, and have pushed out their two first running buds, they are in a proper state for planting out into larger hot-beds. For the farther management of cucumbers and melons, see FEBRUARY.

It is proper that none but such seeds, both of cucumbers and melons, as have been kept for some time, should be sown; those which have been kept for two or three years are to be preferred, because the plants which proceed from them are thought to be, not only more fruitful, but to produce their fruit sooner. Plants which are produced from recent seeds commonly push vigorously, and their shoots grow to a great length before they show a single fruit. The best sorts of cucumbers for producing an early crop, are the early short prickly and long green prickly; the former of these is the earlier, the other produces the best crop and the largest fruit. There are several sorts of melons sown for an early crop, viz. the romana, cantaloupe, polignac, &c. The romana is a very good bearer, and produces early, and is a very well-flavoured, though small fruit. The cantaloupe is a very well-flavoured melon, acquires a good size, and ripens early. The polignac is also a very good melon. It is better, however, to sow two or three kinds, if they are easily to be had, for the sake of gaining greater variety.

Hot-beds may be formed any time this month for forcing asparagus: they are to be formed in the same way as hot-beds for cucumbers and melons; the dung, however, need not be raised to the same height, from two and a half to three feet will be sufficient. After a bed has been formed, it should be covered with earth to the depth of six or seven inches, and the asparagus plants immediately put in; but the frame and glasses are not to be put on till after the violent heat of the bed shall have subsided, and the rank steam escaped. A sufficient quantity of asparagus plants, proper for forcing, must be provided; viz. such as have been raised from seed and planted out in the open ground for two or three years, as directed elsewhere; six hundred will be sufficient for a frame of three lights, and so on in proportion, for a larger or smaller frame. The strongest and most vigorous plants ought to be chosen, and should be planted very close together, that the quantity produced may repay the trouble and expence of forcing. Having marked the size of the frame on the surface of the bed, raise a ridge of earth a few inches high, against which place the first row of plants, and draw a little earth over the roots of each; next to them another row may be planted as close as possible, and so on till the whole space is covered, some moist earth should be applied all round the outside of the space, occupied by the plants, and raised an inch or two above their tops. Then the whole should be covered with a quantity

quantity of rich light earth, to the depth of about two inches, and left in that situation till the buds begin to appear above ground. They should then receive an additional covering of rich light earth to the depth of three or four inches. A wreath of strong straw band is previously fixed by some round the bed, which both supports the last covering of earth and the frame. The straw ropes should be about four inches thick, and fixed down all round the edge of the bed, exactly in that place where the frame is to be put. Should there be no reason to suspect overheating or burning, the frame may be immediately put on; care should be taken to raise up or shove down the glasses to allow the rank steam to escape, particularly about the time the buds begin to appear. If much rain or snow should fall after the bed has been formed, and before the frame is put on, it will be necessary to cover the bed with mats or with straw. The heat of the bed likewise during that time should be carefully examined; with that view, two or three sticks, called *watch sticks*, should be stuck in the dung, to be pulled out occasionally, and examined by applying the hand to their extremities; or the heat may be better regulated by the agricultural thermometer, invented and constructed by Mrs Lovi of Edinburgh. If there be danger of burning, it is moderated by boring several wide holes in the dung on each side of the bed, and in the earth immediately under the roots of the plants, to admit air, and let the rank steam pass off: these holes should be shut after the heat of the bed is become moderate. The outside of the bed should be protected in wet, or cold windy weather, and when its heat decays, it is revived by means of lining, as directed in cucumber and melon beds. After the asparagus begins to appear above ground, due attention should be paid to the regular admission of air, whenever the weather is at all moderate; and care must be taken to cover the beds with mats during severe weather, and constantly during the night. In four or five weeks after the formation of the bed, the asparagus will be fit for cutting, and will continue to produce abundantly for two or three weeks longer. During that time three or four hundred may be collected every week from a three light frame. They must not be cut, as is the case when asparagus is collected in the open air, the fingers must be introduced into the earth, and the buds are to be broken off close to the roots.

3 Sow roots. When carrots are required early, make a hot-bed about two feet thick of dung, and cover it to the depth of six inches with light rich earth. Sow the seed thin, and cover it to the depth of a quarter of an inch. Admit air freely in mild weather through the day, and cover them during the night. When about an inch or two high, thin them to about three inches asunder, they will be fit for drawing in April or May.

Sow rape, cresses, mustard, and radish, in a slight hot-bed. The dung should not exceed the thickness of eighteen inches or two feet, and should be covered with five or six inches of light dry earth. The seeds may be sown very thick, either in drills or all over the surface of the bed, and covered slightly. The bed should be covered with a frame and glasses, and protected during the night and severe weather, with mats. Whenever the weather will permit, air must be admitted, otherwise the plants will be apt to die as fast as they come up.

Where mint, tansey, and terragon, are required very early, a slight hot-bed may be prepared and covered with earth to the depth of five or six inches, in which the roots of mint, tansey, and terragon, may be planted and covered with a frame and glasses.

About the beginning of this month, some peas and beans may be sown in a hot-bed, either for transplanting into a warm border in the open air, or into other hot-beds where they are to remain, and produce a crop; the early framing pea is best for this purpose. 35 Early peas and beans.

A hot-bed may be formed, in which some early dwarf potatoes may be planted, either to be planted out afterwards, or to remain to produce a crop. 36 Early potatoes.

Sow some early kidney beans in a hot-bed, or in pots to be placed in a hot-house. Fill moderate sized pots (24s) with rich light earth, and sow three or four beans in each pot. When the plants have come up, give them a moderate quantity of water; they will produce a crop in March and April. 37 Early kidney beans.

Sect. II. *Fruit Garden.*

January. Fruit Garden.

If any apple or pear trees remain unpruned on walls or espaliers, that work may be performed any time this month, even though the weather should be frosty; some people indeed think it improper to prune trees during frost, lest the trees should receive injury by having their cut surfaces exposed to the action of the frost; but their apprehensions are chimerical. 38 Apple and pear trees to be pruned.

Apple and pear trees produce their flower buds on short branches, (or spurs as they are termed), which proceed from the sides of the branches of one or more years standing, and which every year increase in number, while the branches from which they proceed continue vigorous: if these branches, which throw out spurs, be shortened or cut at their extremities, they commonly push out a number of smaller branches, which acquire considerable length, but form no flower buds; it is therefore proper in pruning these trees, to take care never to shorten a leading branch where there is room on the wall or espalier to allow it to be extended, unless when a supply of new wood is wanted to fill up a vacancy. In young trees which have not yet formed a sufficient head, select the most vigorous and best placed shoots, and train them to the wall or espalier, at the distance of from four to six inches from one another; any branches that intervene between them are to be removed close to their origin, and all those branches which do not apply well to the wall or espaliers may likewise be removed. When the branches are too thin, and a supply of wood is wanted, one or more of the last year's shoots may be cut down to within a few inches of its origin; four or five buds are commonly left. These branches, so shortened, commonly push out three or four shoots the ensuing season. The young branches that have been laid in at full length, will in two or three years produce a good many spurs or short branches along their sides, from which a crop of fruit may be expected. In old trees, that have been already trained, all the vigorous bearing branches are to be retained, unless where they may happen to be too crowded, then the branch intended to be removed should be cut out close to its insertion. When any of the old bearing branches seem to be worn out, or decayed, they should be pruned out near

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near to their insertion; from the stump that is left some shoots will be pushed out the following season, the best of which may be retained, to supply the place of the branch removed. All the leading branches ought to be looked over, and the superfluous fore-right and misplaced shoots of last year's growth which will not easily apply to the wall, ought to be cut off close to their insertion into the main branch; the most vigorous and best placed shoots should be trained at full length to the wall or espalier at the distance of from four to six inches from one another. When there happens to be any vacant space on the wall or espalier, some of the last year's shoots may be shortened, as directed in the pruning of young trees.

In looking over the leading branches, all the spurs which produce flower buds ought to be carefully retained; and any stumps which may have been left, after former prunings, ought to be cut away quite close to the branch from which they proceed, for they constantly produce a redundancy of branches which create confusion, shade the fruit from the sun, and rob it of its proper nourishment.

39 Plum and cherry.

This is a proper season to prune plum and cherry trees either on walls or espaliers: the same directions which have been given for pruning apples and pears will apply to the pruning of plums and cherries, as they likewise produce their fruit on spurs, pushed out from nearly the extremity of the shoots, which are two or three years old It is improper in pruning to shorten the branches, because the very part would be removed from which the fruit buds should proceed next or subsequent season.

40 Peach, nectarine, &c.

These trees produce their fruit on the young branches of last year. A plentiful supply of last year's shoots must therefore be retained to be nailed to the wall, at the distance of from three inches to half a foot from one another; the most vigorous and best placed shoots are to be selected for this purpose, and all fore-right, weakly or superfluous shoots are to be removed, likewise some of the last year's bearers. That the pruning knife may be used more freely, it would be proper not only to unnail the shoots which had been laid in last year, but even some of the principal branches. In selecting the branches, attention must be paid not only to their position and proper distance, but likewise to the quantity of flower buds they contain. These buds are distinguishable from those which produce branches by their roundness; and towards spring when the buds begin to swell, by their size: those which produce branches being generally small, flat, and pointed. It frequently happens that one of each is prodnced at the same eye (as it is termed), or sometimes two flower buds, with a branch bud between them. All very strong thick branches are to be rejected, as well as those that are long, small, and feeble, because the very vigorous branches are much more apt to run to wood, than to produce fruit. Those branches which are selected as the fittest to be retained, ought to be shortened (due regard being paid to their vigour, and to the number and situation of the flower buds they contain), which will make them push out two or three branches the ensuing summer, the best of which may be retained for next year's bearers.

In weak trees that are not disposed to push vigorously, the smaller shoots may be shortened to the length of six or eight inches; the more vigorous shoots may be left from ten to fifteen inches long, or thereby. In trees of moderate growth the branches ought to be left proportionally longer, the smaller ones from half a foot to ten inches, the more vigorous from one foot to a foot and a half. In very vigorous trees, the branches ought to be shortened but little, and some of them not at all, the smaller shoots may be shortened to the length of a foot or fifteen inches; the more vigorous shoots should have only about a third or fourth part of their length cut off; and the most vigorous should not be shortened at all, for the more they are shortened, the more they are disposed to push vigorously and run to wood, and on that account produce few fruit. As the flower buds are sometimes situated near the extremity, at other times near the bottom of the branch, this circumstance in a certain degree must regulate the shortening the branch, as care must be taken to leave a sufficient quantity of flower buds, where fruit is the object. Care must likewise be taken to have a bud which is expected to produce a branch, at the eye which is next the cut extremity; it is of no moment whether it be alone or in company with one or two flower buds, but it is absolutely necessary to have one to produce a leading branch, without which the fruit will not thrive. When three or four last year's shoots are found on a branch of the preceding year, the one at the upper and lower extremities is frequently preserved; in that case the intermediate ones ought to be cut away close to the branch: but should any of the intermediate ones be selected as the most proper to be retained, the branch of the preceding year should be cut off close by the uppermost of the shoots which has been fixed on, and all these shoots which are to be removed should be cut away close to the branch from which they proceed. After each tree has been gone over, it ought to be carefully nailed to the wall or fixed to the espalier.

Vine and fig.

Vines if cut when in a growing state are apt to bleed very copiously. This bleeding is detrimental to them, and is stopt with great difficulty. If vines are pruned a short time before the rise of the sap, they are likewise liable to bleed at the recently cut extremities; it would therefore be improper any time this month to prune vines which grow in the hot-house or in a vinery which is to be early forced; but such as grow on open walls or in vineyards may be safely cut any time this month. Though it would certainly be adviseable to prune as soon after the fall of the leaf as may be, as in that case the cut extremities would have sufficient time to heal, and all danger of bleeding would be removed.

Fig trees may be pruned any time this month, though perhaps it would be as well to defer it till next or following month. For the method, see FEBRUARY.

Gooseberries and currants may still be pruned. See NOVEMBER.

Plant gooseberries and currants.

Gooseberries and currants may be planted if the severity of the frost does not render the ground too hard; indeed they may be planted any time from the fall of the leaf in autumn till the pushing out of their buds in spring. It is usual to plant them in rows along the borders, or to divide the plots in the kitchen garden; in which case they ought to be planted two or three yards apart, and the distance between the rows must depend on the size of the plots they are to separate (10, 15 or 18 yards). They ought to be trained up with a single

January. Fruit Garden.

single stalk to the height of 10 or 15 inches, which will allow the kitchen crops that may be planted near them to grow freely, and will render the operations of hoeing, weeding, and raking under the bushes easy. They are frequently planted out in compartments by themselves, in which case the bushes ought to stand at the distance of from five to eight feet in the rows, and the rows ought to be eight or nine feet apart.

When plenty of room is allowed between the bushes, they grow freely, and produce larger fruit; free admission is likewise afforded to the sun and air, without which, the fruit would not acquire its proper flavour: hoeing, and digging between the bushes, is more easily performed, and crops of different kinds of kitchen garden productions may be reared in the intervals. Currants are very frequently planted against walls and rails, to which they are regularly trained. Gooseberries also are sometimes planted against walls and rails; those against walls yield early and well-flavoured fruit. The variety of gooseberries is very great, and every season adds new varieties to those already known. The principal kinds are the early rough green, small early red, smooth green, large Dutch red, common hairy red, smooth black, rough white, white crystal, large yellow, rough yellow, large amber, large tawney, &c.

The different kinds of currants are the black, common white, large Dutch white or grape currant, common red, and champaigne.

Rasberries.

Raspberries may be pruned or planted during this or any of the winter months; they produce their fruit on small branches which proceed from the shoots of the former year. Every year they push up a number of shoots from the root, which bear fruit the subsequent summer, and then die. In dressing raspberries, all the old dead stalks must be cut away close by the ground, and all the young ones except four or five of the strongest, which should be shortened a little. All these shoots become small towards their extremity and bend a little; it is the common practice to cut off the bent part, but some shorten them one-third, others one-fourth. After the shoots have been shortened, they ought to be intertwined or surrounded by a bandage of some kind to keep them together, for the sake of mutual support, because when they are allowed to stand single they are apt to be weighed down in summer by the weight of their own leaves and fruit, particularly when loaded with rain, or to be beaten down by the wind; in which case they may frequently lie one over the other, create confusion, and exclude the sun and air from those that are undermost, or may lie so close to the ground as to have their fruit destroyed. After the plants are pruned, the ground between them ought to be dug, and all straggling shoots which advance to a distance from the main plants ought to be taken up.

Raspberries may be planted any time this month when the weather is moderate: when new plantations of them are wanted, they ought to be formed in open situations, if high-flavoured fruit be wished for; but rasps will thrive very well and produce good crops in shadowy situations. The ground in which they are to be planted ought to be well dug, and if a little rotten dung be added, the plants will succeed the better. They ought to be planted at the distance of three feet from each other, in rows four or five feet apart. The offsets which are dug up from between the rows of old plantations of raspberries are commonly made use of for this purpose. Any of the last years shoots that are well rooted and tolerably vigorous will answer perfectly well. Those which have two or three buds, formed on the roots, from which young shoots are to proceed the following summer, are generally to be preferred to those which have fewer though equally vigorous. They ought to be taken up carefully with all their roots, and after the stem has been shortened a little (about one-third) they may be planted at the distances already mentioned. Plantations formed now will yield some fruit the ensuing summer, and a plentiful crop the following season. The kinds of raspberries commonly used are the white, double bearing, (which bears two crops, one in summer the other in autumn), the smooth stalk, the Antwerp (very large).

44 Prepare for planting fruit trees.

If the weather be mild, all kind of fruit trees may be planted any time this month; but if it should be deemed more adviseable to defer planting till next month, the ground may be prepared for their reception any time during open weather. The borders on which fruit trees are to be planted, which are to be trained against walls or espaliers, should be trenched or dug two spades deep. For planting and preparing ground for fruit trees, see OCTOBER.

45 Protect the roots, &c.

The roots of the more tender sorts of fruit trees, viz. peaches, nectarines, apricots, and indeed of all sorts of stoned fruit, which may have been planted any time in the course of the winter, will require to be protected during frost by a covering of straw, or litter mixed with dung, or something of that nature, applied to a considerable distance round the stem, so as to cover the ground completely, and prevent the frost from penetrating.

Protect fig-trees during frosty weather with a covering of mats, or something of that nature, because their shoots being succulent, particularly towards their extremities, are apt to be destroyed by the frost. This is of the more consequence as the fruit is produced from the young shoots only, and chiefly from their extremities, the parts most liable to suffer.

46 Force fruit trees

Where there are vineries, peach, cherry-houses, &c. the glasses ought to be put on about the beginning of the month when it is intended to force early, and fires ought to be applied about the middle or towards the end of it. See *Forcing*, FEBRUARY.

47 and strawberries.

Towards the beginning, middle, or end of the month, hot-beds may be made for forcing strawberries, which, if properly managed, will produce ripe fruit in March or April. The hot-beds are to be formed according to the directions given under the article *Melon*, and *Cucumber*. See *Kitchen Garden*, JANUARY. The dung should be raised at least to the height of three feet, and the frame and glasses put on as soon as the bed is made, which will both protect it from rain or snow, and draw up the steam sooner. As soon as the violent heat is over, the surface of the bed should be covered to the depth of four or five inches with dry earth, or with a quantity of decayed tanners bark taken from an old tan-bed. The pots containing the plants should be plunged up to the rims into the earth or tan with which the bed is covered. They should be placed as close together as possible, and care taken to fill up all the interstices with earth or tan. When all the pots are plunged, put on the glasses and keep them close till the

January. Flower Garden. the steam rise in the bed, when it will be necessary to raise them a little behind, to allow the steam to pass off. The alpine and scarlet strawberry are commonly made use of for this purpose.

The plants should be two years old, and if potted the preceding autumn, they will succeed the better; but if a quantity of plants were not put into pots last autumn for this purpose, that work may be done any time this month during open weather. For the method, see SEPTEMBER. Or the plants may be taken up now with balls of earth, and placed in the beds without being put into pots. When the plants begin to push, let them have plenty of air during favourable weather, for should they be kept too close they will become weakly, and either produce no flowers at all, or their flowers will drop off without yielding fruit. They should likewise be frequently watered and protected during the night in severe weather with a covering of mats. When the heat of the bed begins to decay, it should be renewed by proper linings of fresh dung, applied as directed for melon-beds. As to the size of hot-beds nothing need be said, as that must be regulated by the number of plants intended to be forced. Hot-beds formed of tanners bark, particularly where there are pits constructed on purpose, will answer better than those of horse-dung, because they afford a more equable heat. Where there are pine-houses, or hot-houses of any kind, plenty of strawberries may be obtained early, without much trouble, by placing pots filled with the plants in them any where near the glass.

SECT. III. *The Flower Garden or Pleasure Ground.*

48 Protect flowers in pots. DOUBLE flowers, as sweetwilliams, wallflowers, stocks, rose campion, and auriculas, carnations, &c. kept in pots, ought to be protected in severe weather, either by common garden frames, or by coverings of mats supported on hoops. Due attention must be paid to give them air whenever the weather is mild. Where there are no conveniences of the above description, the pots may be plunged up to their rims in well-sheltered borders close to a south wall. The pots containing hardy plants should likewise be plunged in the earth in some dry situation up to the rims, to protect the roots from frost.

49 Bulbous roots in beds. During severe frosty weather the beds in which the finer sorts of hyacinths, tulips, ranunculuses, anemones, &c. have been planted, should be protected by a covering of mats or straw; but if the plants have begun to make their appearance above ground, the beds should be arched over with low hoops and covered with mats, which ought to be fixed down to prevent their being blown off by the wind; and they should be removed occasionally during mild weather.

50 Plant bulbous roots. If any hyacinth, tulip, narcissus, crown imperial, crocus, or snowdrop roots remain unplanted, they ought now to be put into the ground. For the method of planting them, see OCTOBER.

51 Sow hardy annuals. About the latter end of the month, if the weather is mild, sow a few sweet peas in any warm sheltered situation for flowering early, also some seeds of candytuft, larkspur, adonis, dwarf sunflower, persicaria, venus navel-wort, venus looking-glass, lobel's-catchfly, and pansy violet.

52 Force flowers in the hot-house. Pots of pinks, carnations, roses, Persian or common lilach, hyacinth, polyanthus, narcissus, Italian narcissus, dwarf tulip, jonquil, lily of the valley, &c. may be placed in the hot-house, where they will flower early. As soon as they come into blow they should be removed into a green-house, or the apartments of a dwelling-house, where they will continue longer in flower than they would do if left in the stove, where the great heat would accelerate their decay. All those should have been put into pots the preceding autumn, or at least some time previous to their being introduced into the hot-house. The roses in particular require to be well rooted in the pots before they are forced.

Management of shrubs. Shrubs may now be pruned, which should be performed with a knife and not with garden sheers. All irregular shoots which extend far beyond the rest of the branches should be cut off. A few branches should also be cut out wherever they are too much crowded together, likewise all dead and decayed ones. After the pruning has been finished, the ground in the shrubbery ought to be dug over, and all suckers removed. Where the shrubs are too much crowded together, some of them ought to be taken out; and where any of them have died, or if they stand too distant, some young ones may now be planted to fill up the vacancies.

Of grass walks and lawns. Grass walks and lawns should be kept neat by frequent poling and rolling. Poling may be performed in open dry weather, with a long taper ash pole about twelve or fifteen feet long, which breaks and scatters the worm casts. After this, in moderately dry weather, roll with a wooden roller, to which all the loose worm-casts will adhere. Walks or lawns may also be made this month during open weather. Good turf may be obtained from commons or downs where sheep feed, or from fields which have been long under pasture. Each turf should be marked out a yard long and a foot in breadth, and cut to the thickness of an inch with a turfing iron. As the cutting proceeds, they should be rolled up compactly with the grass side in. If they are not closely rolled up they will be apt to break in carrying. They must be laid on the walk or lawn close to one another after the surface has been rendered level and compact by proper treading, that it may not settle unequally. When they have been put on they must be beat down with a wooden rammer, and afterwards rolled with a large iron or wooden roller.

Of gravel walks. Gravel walks should be cleared of weeds and all decayed leaves, and kept clean; and in dry weather they should be occasionally rolled. New walks may likewise be formed now. For the method, see MARCH.

Edgings. Edgings of boxwood, thrift, &c. may be planted any time this month in open weather. See OCTOBER.

Planting &c. hedges. Hedges of hawthorn, barberry, privet, hazel, holm, yew, birch, elm, elder, &c. may be planted during this month. See NOVEMBER. Old hedges which have become open below should be plashed. See DECEMBER.

Of forest trees. Forest trees for ornamental plantations, coppices, or woods, may be planted either now, or at any time from the fall of the leaf till the rise of the sap in spring. See OCTOBER.

SECT. IV. *Nursery.*

Management of shrubs, trees. PRUNE and transplant shrubs, fruit and forest trees. Trim the stems of forest trees, and cut off all irregular uary. een- and House.

regular rambling shoots of shrubs, and reduce them to a regular neat form. This work may be executed any time this month, even during frost, when little else can be done. All kinds of hardy deciduous shrubs, fruit, and forest trees, may be transplanted during open weather.

Dig ground in open weather, and wheel out dung in frost.

Vacant compartments of ground may be dug any time during open weather; and likewise after the necessary pruning has been given to the trees and shrubs, the ground between the rows may be dug, and all weeds carefully buried.

Of seed-lin

The young plants of many of the tenderer kinds of trees and shrubs, such as cedar of Lebanon, and some other species of pine, cypress, chinese arbor vitæ, strawberry-tree, &c. require to be protected during frost. If they have been raised in boxes or pots, they may be placed in garden frames and occasionally covered with the glasses; but care must be taken always to remove the glasses in mild open weather. If the plants stand in beds in the open ground, they may be covered with mats supported on hoops, which must be removed during favourable weather, or a covering of pease straw, or something of that nature may answer the purpose.

Propagate trees &c. by layers.

Layers of many kinds of trees and shrubs may be made any time this month during open weather; many of them which are laid now will be well rooted and fit for removing by October; for the method, see NOVEMBER.

By cuttings.

Put in cuttings of honeysuckles, gooseberries, currants, &c. indeed most kinds of trees and shrubs may be propagated by cuttings. For this purpose select the straight shoots of last year's growth; take them off by a clean cut with a sharp knife, and reduce them to the length of ten, twelve, or fifteen inches, by cutting off part of their smaller extremities. Plant them in rows a foot apart, and at the distance of four or five inches from one another in the rows, taking care to insert one-third or one half of their length into the ground. Though cuttings will grow when their smaller extremities are put into the ground, they never succeed so well in this inverted position, therefore in planting, attention should be paid to place them in their natural position. Older and longer branches of some trees and shrubs, viz. willow, elder, &c. may be employed as cuttings.

By suckers.

Gooseberries, currants, roses, lilachs, and many other shrubs and trees, may be propagated by suckers or offsets from the roots; these may be taken off any time this month, and planted in rows. Previous to their being planted it would be proper to trim off part of their extremities.

SECT. V. *Green-House and Hot-House.*

The air to be cautiously admitted.

DURING frost, keep the glasses shut; but whenever the weather is mild, give the green-house air by opening the glasses more or less according to the state of the weather: even in the brightest mild days during this month the glasses should not be opened until about ten o'clock in the morning, and ought to be shut again about three in the afternoon. In dull foggy days, even though the weather be mild, they should be opened but little, and that for a short time, and in very damp weather, not at all. When very severe frost prevails, fires must be put on, and the flues gently warmed; but the temperature of the air should not be raised higher than merely to keep off the effects of the external frost. A little fire should likewise be put on during very wet weather to banish the damps. Water should be given to such plants as require it, but sparingly. Succulent plants, such as aloes, &c. require little or no water at this season. All dead and decayed leaves should be carefully picked off, and the green-house kept clean.

January. Green-house.

65 Pine apple plants require attention.

Particular attention must be paid to the pine apple plants which are to produce fruit the ensuing summer, as many of them in the course of this month begin to shew flowers. If due attention be not now paid to keep up a proper heat, both in the tanned bed and in the air of the hot-house, the plants may receive such a check as will considerably affect the size of the future fruit. The bark bed must be carefully examined; and if the bark be much decayed and the heat found on the decline, a quantity of fresh tanners bark should be prepared to be added as a refreshment to the old. The pots containing the pine apple plants should then be taken out of the tan pits, and a quantity of the decayed tan removed from the surface and sides of the pits, to make room for the fresh tan which is to be added. The old tan must likewise be turned up from the bottom, and well mixed with the new, after which the pots must be again plunged into the tan. But if, on examination, the heat of the tan pit be found good, and the tan not much decayed, it will be sufficient to turn the old tan, and to mix it well together without making any addition of new. This operation will revive the heat of the bed, and preserve it in good condition for some time to come. The heat of the air in the house must likewise be attended to, and regulated by the thermometer and by due attention to the fires. Moderate watering must be given once a week or ten days, according as the pine apple plants may seem to require it; and care must be taken not to pour any of the water into their hearts or among their leaves.

The other plants in the hot-house must be regularly watered; but those of a succulent nature, such as the different species of aloe, euphorbia, mesembryanthemum, &c. require very little water at a time, and that but seldom.

66 Kidney beans.

Kidney beans, sown in pots or in narrow boxes of about two or three feet long, may be reared in the hot-house. Those sown this month will produce fruit in April or March. When sown in pots, two or three may be put into each, and covered about an inch deep: When in boxes they may be planted to the depth of an inch along the middle, at the distance of two or three inches from one another. The pots or boxes may be placed on the crib of the bark bed, on shelves, or any convenient situation, within the house, where they may not encumber the other plants. After the plants have come up, they should be regularly and frequently watered. The kinds commonly used for this purpose are the early speckled dwarf, negro dwarf, and dun-coloured dwarf.

67 Cucumbers.

Cucumbers may be raised with tolerable success in the hot-house, which will produce fruit early in spring. If the plants have been raised in small pots, plunged in the tan of the bark bed, or in hot-beds made of horse dung, they should be transplanted into larger pots or boxes, in which they may remain and produce fruit; or

February. Kitchen Garden.

or the seeds may be sown at once in the pots where they are to remain. In this case six or eight seeds may be sown in each pot, or patches containing that number may be sown at proper intervals in long narrow boxes. When the plants have come up, only two or three of the strongest should be left in each pot or patch. The pots or boxes may be placed in any convenient situation in the hot-house, but will succeed best on a shelf fixed near the top of the house, within a short distance of the glass. The plants must be frequently watered, and have some small rods fixed near them, to which the runners may be fastened.

FEBRUARY.

Sect. I. *Kitchen Garden.*

68 Admit air to cauliflower plants. The cauliflower plants, which are under frames, should have plenty of air. Indeed, whenever the weather will permit, the glasses ought to be taken off entirely.

About the end of the month, if the weather be mild, some of the strongest plants may be transplanted into the situations where they are to remain. They ought to be planted in good well-manured ground, in a warm situation, at the distance of two feet and a half each way from one another. The same attention must be paid to cauliflowers under bell or hand-glasses. When more than two plants happen to be under one glass, the weakest of them should be planted out about the end of the month, if the weather be mild, and only one or two should be left under each glass: but if the weather is unsettled or severe, transplanting ought to be deferred till next month.

69 Sow cauliflowers. Some cauliflower seed may be sown any time this month to produce plants to succeed those that have been preserved during winter under frames or hand-glasses, or to supply the place of those which may have been cut off by the severity of the weather.

For this purpose make a slight hot-bed of horse dung, to the height of 20 inches or two feet; cover it with a light rich earth to the depth of four or five inches, on the surface of which sow the seeds, and cover them to the depth of a quarter of an inch with earth of the same description. After the seed has been sown, a frame and glasses should be put on, if one can be spared for this purpose; and when the plants begin to appear above ground, they should have plenty of air, whenever the weather will permit, otherwise they will be drawn up and become weak. The glasses, therefore, (unless in very severe weather) should be raised every day, and in mild ones taken off entirely. When there are no glasses to spare, the bed may be covered during the night, and in severe weather, with mats properly fixed over it. The plants should be sprinkled with water from time to time, if moderate showers should not render this unnecessary.

70 Transplant cabbages. Cabbage plants, if tolerably strong, should be transplanted in the course of this month. See *Planting out cabbages*, January.

71 Sow cabbages. About the middle, or towards the end of the month, sow some cabbage and savoy seed to raise plants for late crops in summer and autumn. Both the early and late kinds of cabbage may be sown now, but it is better to sow them in August; but if none were sown in autumn, or if the plants raised then have been cut off by the severity of the winter, a quantity of both early and late should be sown the first opportunity this month. That the plants may sooner acquire sufficient strength for planting out, it would be proper to sow them in a slight hot-bed.

72 Small salad. Where small salad is required, let some seeds of mustard, cress, radish, rape, &c. be sown regularly every eight or ten days during the course of the month. See January.

73 Celery. Earth up celery in open dry weather if the plants have advanced much above ground. Sow some upright celery seed for an early crop about the middle or towards the end of the month, in a small bed of rich light earth in a warm situation. There are three ways in which this may be performed. 1st, The earth of the bed should be well broken with the spade; the seed sown on the rough surface and raked in. 2dly, The surface of the bed may be made smooth; the seed sown and covered to the depth of a quarter of an inch with light rich earth. 3dly, A quantity of earth, to the depth of about half an inch, should be removed with the back of a rake from the surface of the bed into the alleys, which, after the seed has been sown, should be gently replaced with the rake. Those who are very anxious to have early celery, should sow some in a slight hot-bed. The plants raised now will be fit for use in June or July; but it would be adviseable to sow few at this season, as they will be very apt to pipe or run up to seed before they acquire sufficient size: there are two kinds of celery, the Italian, and turnip-rooted or celeriac.

74 Radish. About the beginning of this month sow some short-topped radishes to succeed those sown last month, and some salmon and Italian radishes at any time during the month. See January.

75 Spinach. Some round-leaved spinach may be sown any time in the course of the month, to succeed that which was sown last month. See January.

76 Peas. Some early peas may be sown this month. This is likewise a proper season for sowing a full crop of late peas, such as marrowfats, rouncivals, Carolina, and sugar pea, &c. For the distances at which they are to be sown, see January.

77 Beans. This is the proper time to plant beans. For the method and distances, see January.

78 Earth peas and beans. Such peas and beans as are sufficiently advanced in growth should now be earthed up.

79 Sow and transplant lettuce. In mild open weather sow some seeds of green and white cos lettuce, likewise some Sicilian, imperial, brown Dutch, and common cabbage lettuce. See January.

If young lettuce plants are wanted for transplanting early, they should be sown in a slight hot-bed or in some warm sheltered situation; and when they have advanced to the height of about two inches, they may be planted out in the open ground. Lettuces that have stood the winter in frames, under hand-glasses, or in warm borders, should be thinned and left standing at the distance of one foot from each other, and those that are drawn out should be planted in some proper situation.

80 Sow carrots and parsnips. About the middle or end of this month sow some carrots and parsnips. They succeed best in light deep soil, and in an open situation. The ground should be dug, at least one spade deep or two, if the depth of the soil will

will admit, and the clods ought to be well broken. They may be sown either broadcast, in narrow beds, or in drills. See MARCH.

Sow some seeds of red, white, and green beet, likewise of mangel wurzel or German beet. The fine red root of the first is used as a pickle, &c.; the leaves of the white and green are made use of in soups, &c.; and the large leaves of the mangel wurzel are boiled and used as spinach. The footstalks of its leaves are likewise used as asparagus. Each kind should be sown separately, either broadcast or in drills, an inch deep, and about a foot apart; but the mangel wurzel requires more room than the other kinds, because it is of larger growth. After the plants have come up, they should be thinned out, to the distance of six or eight inches from each other. The seed may likewise be dibbled in rows, about a foot apart, and at the distance of six or eight inches from each other in the rows. Two or more seeds may be put into each hole; and when the plants appear above ground, one of the strongest only should be left.

Some of last year's carrots, parsnips, and beets, should be planted out in rows, two feet apart, and one foot distant from each other in the row, to stand and produce seed.

Some onions and leeks may be sown in mild dry weather, any time after the middle of this month. The ground should be well dug, and the seeds sown when the surface is dry, and then raked in. The best mode is to divide the ground into beds of about four feet wide, for the convenience of thinning, weeding, &c.; but they may also be sown in plots, without being divided into beds, in which case, if the soil be light, the seed may be gently trodden in, before the surface is raked. The leeks will be fit for transplanting in June and July, and the onions for drawing in August. Sometimes a small quantity of leek-seed is sown along with the onion; and when the onions are drawn in August, the leeks are allowed to remain to acquire a proper size; but it is better to sow each separately. The principal kinds of onion are Strasburg, Deptford, Spanish, Portugal, long keeping, and red.

The Hamburgh parsley and scorzonera are cultivated for their roots; the salsafy for its roots and tops. The roots of all of them, if sown now or any time in spring, will be fit for using in autumn, and continue good all winter. The Hamburgh parsley roots are not only used for culinary purposes, but recommended in medicine. They are said to be useful in the gravel. The seeds may be sown in drills, six inches apart, and covered with earth to the depth of half an inch. The plants should be thinned in May or June, and left standing at the distance of six inches from each other in the rows.

About the middle of the month you may sow seeds of burnet, lovage, angelica, marigold, fennel, dill, sorrel, chervil, and clary. Each kind should be sown separately, either in the place where they are to remain, or they may be transplanted in summer. See JUNE.

About the middle or end of the month sow marjoram, thyme, savory, and hyssop. The plants may either remain where sown, or be planted out in the beginning of summer. See JUNE.

Towards the end of the month plant shalot, garlic, and rokambole. Having procured a quantity of their roots, divide and plant them in rows nine inches apart and six inches distant from each other in the row. They may be put in to the depth of two inches with the dibble, or placed in drills, two inches deep, drawn with a hoe. February. Kitchen Garden.

This is a proper time to raise a full crop of parsley. See JANUARY. 87 Parsley.

A few potatoes may be planted about the middle or end of this month for an early crop; but if wanted very early, some early dwarf potatoes should be planted in a slight hot-bed. For the method of planting, see MARCH. 88 Potatoes.

Horse radish is propagated by offsets or cuttings of the roots, about three inches long, which may be planted either with the dibble or spade, at the distance of six or eight inches from each other, in rows two feet apart. When they are planted with the dibble, the holes ought to be made 10 or 12 inches deep; when with the spade a trench should be made a full spade deep, in the bottom of which the offsets or cuttings should be placed erect, and covered with earth from the next trench. As they will not appear above ground till the month of May, a crop of spinach, radishes, or small salad, may be got from the ground, and cleared off before the horse radish appears. After the plants have come above ground, they ought to be kept clear of weeds. 89 Horse radish.

About the middle or towards the end of the month, sow some seed of the early Dutch turnip in a border of light earth, in a warm situation. See MARCH. 90 Sow turnip.

If no preparations were made last month for raising early cucumbers and melons, they may be commenced, any time this month, with better prospect of success. For the method of forming and managing the seed-bed, see JANUARY.—If the cucumbers and melons, sown last month and transplanted into small pots, be fit for ridging out, a hot-bed for one or more frames should be got ready for their reception, which should be raised to the height of three feet and a half, and covered with a frame and glasses. About a week afterwards, if the hot-bed has settled unevenly, the frame and glasses should be removed; and after the surface of the bed has been made perfectly level, replaced. As soon as the violent heat has subsided, the rank steam escaped, and all danger of burning apparently over, cover the bed to the depth of two inches with dry light rich earth, and raise a conical heap of the same earth, to the height of about 10 inches, immediately under the centre of each light. By the following day the earth will have acquired a proper warmth, and the bed will be fit for the reception of the young plants. The earth, laid over the surface of the bed, to the depth of two inches, will prevent the rank steam of the dung, on the one hand, from rising up freely, and yet not keep it down altogether: were much of the surface of the dung exposed, and the steam allowed to escape freely, the young plants would be destroyed; and, on the other hand, were it prevented from escaping altogether, by laying on earth to a sufficient depth at once, the bed would become overheated, and the roots of the plants might be burnt. 91 Cucumbers and melons.

The pots containing the young cucumber and melon plants, which were transplanted last month (see JANUARY), should be well watered the day previous to their being ridged out, to make the ball of earth adhere, and come out of the pot entire. After the tops of the hillocks of earth, which had been raised to the height 92 Management of the former crop.

February. Kitchen Garden.

height of 10 inches under each light, have been flattened by reducing their height about two inches, make a hole in the centre of each, capable of containing one of the balls of earth, which is to be turned out of the pots. Select some pots containing the strongest plants; place your hand on the surface of the pot, allowing the plants to pass between your fingers; invert it, and strike the edge of it gently against the frame till the ball of earth comes out, which should be put into one of the holes in the hillock just mentioned; close the earth round the ball, and make it rise about an inch over its surface. After they have been thus ridged out, they should receive a gentle watering, and be covered with the glasses till the steam begin to rise much, when air should be given by raising the glasses. These hot-beds, into which the cucumbers and melons have been finally transplanted, must be managed in the same manner as the nursery beds, mentioned last month. A covering of straw, or something of that nature, should be laid all round the dung; linings of fresh dung should be applied to the sides of the bed when the heat begins to decline, air admitted under the same circumstances and with the same precautions as there stated. If three cucumbers or two melons have been planted in the pots, as before directed, one of the weakest of either should be removed immediately before, or after they are ridged out. Should any symptoms of burning appear soon after the plants have been ridged out, part of the earth, close to the bottom of the hillocks, must be removed; and as soon as the violent heat has subsided, be replaced with fresh earth. When the heat of the bed begins to decline a little, especially if any of the roots of the plants shew themselves through the sides of the hillocks, a quantity of fresh earth should be applied all round them, which should be kept within the frame for one night previously, that it may acquire a proper temperature, for should it be applied cold, it might injure the young roots. Two or three days after this an additional quantity of fresh earth should be applied to the sides of the hills; and in two or three more the whole surface of the bed may be earthed over as high as the tops of the hills.

93 Topping.

When the plants have got two rough leaves, and when the second is about an inch broad, the bud, which is situated at the axilla (or base) of the second rough leaf, must be removed either with the finger, a pair of scissars, or a pen-knife, or, when the bud is very small, with a needle or pin, being careful not to injure the joint. After the plants are thus topped or stopped, they soon acquire strength; and in about 10 or 12 days, each of them will throw out two or three runners, which will shew flowers sometimes at the second or third joint. Were the plants not to be topped, the principal shoots would probably advance to the length of about two feet, without sending off any runners to fill up the frame, and without shewing a single flower. If none of the runners, which are pushed out after the first topping, shew flowers at the third or fourth joint, they should be topped likewise, which will cause each of them to push out two or three runners, all of which may perhaps prove fruitful. As these runners advance in growth they ought to be trained regularly along the surface of the beds, and all very weak or redundant shoots removed. The cucumbers, if well managed, will be fit for the table about the end of this or beginning of next month; but the melons will not be ripe before May or June.

Impregnation of the flowers.

Cucumbers and melons have male and female flowers on the same plant, which are easily distinguished from one another. The male flowers, in the centre of which the antheræ are situated that contain the farina (or fecundating powder), have stalks of an equal thickness, without any swell immediately under the flowers; whereas a swelling is perceptible immediately under the female flowers which contain the female organ of generation, as soon as they are pushed out from the stalks of the plant, which is the germen or future fruit. If none of the farina of the male be conveyed into the female flower, the germen decays, becomes yellowish, and drops off. It becomes therefore necessary, particularly at this early period, to impregnate the female flowers by suspending male flowers over them, and shaking some of the farina into the pistillum (or female organ); for after the plants have continued some time in flower, the air of the hot-bed in which they grow becomes loaded with the farina, by which means it is wafted into the female flowers. Insects likewise, particularly bees, at a more advanced period of the year, serve to convey it from flower to flower. As soon as the female flowers have opened, pinch off a newly blown male flower, together with a portion of its foot stalk, remove the greatest part of its corolla or flower leaf, introduce it into the female flower, and either touch the pistillum of the female gently with the antheræ of the male so as to make some of the farina adhere, or shake the male flower over the pistillum of the female in order to make some of the farina fall on it. In a day or two after impregnation the germen or future fruit begins to swell, and in about a fortnight, if the weather be favourable and the heat of the bed good, the young cucumbers may be brought to table. This operation may be employed to produce new varieties, not only of cucumbers and melons, but of many other vegetables. Were the female of one variety of melon to be impregnated with the farina of another, a kind would be produced partaking somewhat of the properties of both; thus a large melon, not possessed of much flavour, might be improved by intermixture with one superior in flavour but inferior in size. In hermaphrodite flowers this operation of impregnating, or crossing, as it is called by cattle breeders, is performed by removing the antheræ from a flower of one species, and impregnating it with the farina of another of the same natural family. The plants proceeding from such a commixture partake more of the properties of the male than the female parent. We have seen a hybrid produced from the *papaver somniferum* impregnated with the farina of the *papaver orientale*, so like the male parent as with difficulty to be distinguished from it.

The *papaver orientale* produces only one flower on a stalk; some of this hybrid however carried more than one, and in this particular alone it resembled the *papaver somniferum*, which branches very much. Mr Knight has made some curious and interesting experiments on this subject, which he has detailed in the following letter to Sir Joseph Banks, published in the Transactions of the Royal Society. "The result of some experiments which I have amused myself with making on plants, appearing to me to be interesting to the naturalist, by proving the existence of superfœtation in in the vegetable world, and being likely to conduce to some improvements in agriculture, I have taken the liberty to communicate them to you. The breeders of animals have very long entertained an opinion that considerable advantages are obtained by breeding from males and females not related to each other. Though this opinion has lately been controverted, the number of its opposers has gradually diminished, and I can speak from my own observation and experience, that animals degenerate in size, at least on the same pasture, and in other respects under the same management, when this process of crossing the breed is neglected. The close analogy between the animal and vegetable world, and the sexual system equally pervading both, induced me to suppose that similar means might be productive of similar effects in each; and the event has, I think, fully justified this opinion. The principal object I had in view, was to obtain new and improved varieties of the apple, to supply the place of those which have become diseased and unproductive by having been cultivated beyond the period which nature appears to have assigned to their existence. But as I saw that several years must elapse before the success or failure of this process could possibly be ascertained, I wished in the interval to see what would be its effects in annual plants. Amongst these none appear so well calculated to answer my purpose as the common pea, not only because I could obtain many varieties of this plant, of different forms, sizes, and colours, but also because the structure of its blossom, by preventing the ingress of insects and adventitious farina, has rendered its varieties remarkably permanent. I had a kind growing in my garden, which, having been long cultivated in the same soil, had ceased to be productive, and did not appear to recover the whole of its former vigour when removed to a soil of a somewhat different quality: on this my first experiment in 1787 was made. Having opened a dozen of its immature blossoms, I destroyed the male parts, taking great care not to injure the female ones; and a few days afterwards, when the blossoms appeared mature, I introduced the farina of a very large and luxuriant gray pea into one half of the blossoms, leaving the other half as they were. The pods of each grew equally well, but I soon perceived that in these into whose blossoms the farina had not been introduced, the seeds remained nearly as they were before the blossoms expanded, and in that state they withered. Those in the other pods attained maturity, but were not in any sensible degree different from those afforded by other plants of the same variety; owing, I imagine, to the external covering of the seed (as I have found in other plants) being furnished entirely by the female. In the succeeding spring the differenee however became extremely obvious, for the plants from them rose with excessive luxuriance, and the colour of their leaves and stems clearly indicated that they had all exchanged their whiteness for the colour of the male parent. The seeds produced in autumn were dark gray.

"By introducing the farina of another white variety, (or in some instances by simple culture), I found this colour was easily discharged, and a numerous variety of new kinds produced, many of which were in point of size and in every other respect much superior to the original white kind, and grew with excessive luxuriance, some of them attaining the height of more than twelve feet. I had frequent occasion to observe in this plant a stronger tendency to produce purple blossoms and coloured seeds than white ones; for when I introduced the farina of a purple blossom into a white one, the whole seeds in the succeeding year became colonred; but when I endeavoured to discharge this colour by reversing the process, a part only of them afforded plants with white blossoms; this part sometimes occupying one end of the pod, and being at other times irregularly intermixed with these which, when sown, retained their colour. It might perhaps be supposed that something might depend on the quantity of farina employed; but I never could discover, in this or any other experiment in which superfœtation did not take place, that the largest or smallest quantity of farina afforded any difference in the effect produced.

"The dissimilarity I observed in the offspring afforded by different kinds of farina in these experiments, pointed out to me an easy method of ascertaining whether superfœtation, (the existence of which has been admitted amongst animals), could also take place in the vegetable world. For as the offspring of a white pea is always white, unless the farina of a coloured kind be introduced into the blossom; and as the colour of the gray one is always transferred to its offspring though the female be white, it readily occurred to me, that if the farina of both were mingled or applied at the same moment, the offspring of each could be easily distinguished.

"My first experiment was not altogether successful, for the offspring of five pods (the whole which escaped the birds) received their colour from the coloured male. There was, however, a strong resemblance to the other male in the growth and character of more than one of the plants, and the seeds of several in the autumn very closely resembled it in every thing but colour. In this experiment, I used the farina of a white pea, which possessed the remarkable property of shrivelling excessively when ripe, and in the second year I obtained white seeds from the gray ones above mentioned, perfectly similar to it. I am strongly disposed to believe, that the seeds were here of common parentage; but I do not conceive myself to be in possession of facts sufficient to enable me to speak with decision on this question.

"If, however, the female afford the first organized atom, and the farina act only as a stimulus, it appears to me by no means impossible, that the explosion of two vesicles of farina at the same moment (taken from different plants) may afford seeds (as I have supposed) of common parentage, and as I am unable to discover any source of inaccuracy in this experiment, I must believe this to have happened.

"Another species of superfœtation, (if I have justly applied the term to a process in which one seed appears to have been the offspring of two males), has occurred to me so often as to remove all possibility of doubt as to its existence. In 1797, that year after I had seen the result of the last-mentioned experiment, having prepared a great many white blossoms, I introduced the farina of a white pea, and that of a gray pea, nearly at the same moment into each, and as in the last year, the character of the coloured male had prevailed, I used its farina more sparingly than that of the white one, and now almost every pod afforded plants of different

February. Kitchen Garden.

ferent colours. The majority however were white, but the characters of the two kinds were not sufficiently distinct to allow me to judge with precision whether any of the seeds produced were of common parentage or not. In the last year I was more fortunate, having prepared blossoms of the little early frame pea, I introduced its own farina, and immediately afterwards, that of a very large and late gray kind; and I sowed the seeds thus obtained in the end of the last summer. Many of them retained the colour and character of the small early pea not in the slightest degree altered, and blossomed before they were 18 inches high, whilst others (taken from the same pods) whose colour was changed, grew to the height of more than four feet, and were killed by the frost before any blossoms appeared.

"It is evident that in those instances, superfœtation took place, and it is equally evident that the seeds were not all of common parentage. Should subsequent experience evince that a single plant may be the offspring of two males, the analogy between animal and vegetable nature may induce some curious conjectures relative to the process of generation in the animal world.

"In the course of the preceding experiments, I could never observe that the character either of the male or female in this plant at all preponderated in the offspring, but as this point appeared interesting, I made a few trials to ascertain it. And as the foregoing observations had occurred in experiments made principally to obtain new and improved varieties of the pea for garden culture; I chose for a similar purpose the more hardy varieties usually sown in the fields. By introducing the farina of the largest and most luxuriant kinds into the blossoms of the most diminutive, and by reversing this process, I found that the powers of the male and female in their effects on the offspring are exactly equal. The vigour of the growth, the size of the seeds produced, and the season of maturity, were the same, though the one was a very early, and the other a late variety. I had in this experiment a striking instance of the stimulative effects of crossing the breeds; for the smallest variety, whose height rarely exceeded two feet, was increased to six feet, whilst the height of the large and luxuriant kind was very little diminished. By this process, it is evident that any number of new varieties may be obtained; and it is highly probable, that many of these will be found better calculated to correct the defects of different soils and situations, than any we have at present; for I imagine that all we now possess have in a great measure been the produce of accident, and it will rarely happen, in this or any other case, that accident has done all that art will be found able to accomplish.

"The success of my endeavours to produce improved varieties of the pea, induced me to try some experiments on wheat, but those did not succeed to my expectations. I readily obtained as many varieties as I wished, by merely sowing the different kinds together, for the structure of the blossoms of this plant, (unlike that of pea), freely admits the ingress of adventitious farina, and is thence very liable to sport in varieties. Some of these I obtained were excellent, others very bad; and none of them permanent. By separating the best varieties, a most abundant crop was produced, but its quality was not quite equal to the quantity, and all the discarded varieties again made their appearance. It appeared to me an extraordinary circumstance, that in the years 1795 and 1796, when almost the whole crop of corn in this island was blighted, the varieties thus obtained, and these only, escaped in this neighbourhood, though sown in several different soils and situations.

"My success in the apple (as far as long experience and attention have enabled me to judge from the cultivated appearance of trees which have not yet borne fruit) has been fully equal to my hopes. But as the improvement of this fruit was the first object of my attention, no probable means of improvement either from soil or aspect were neglected. The plants, however, which I obtained from my efforts to unite the good qualities of two kinds of apple seem to possess the greatest health and luxuriance of growth, as well as the most promising appearance in other respects. In some of these, the character of the male appears to prevail; in others, that of the female; and in others both appear blended, or neither is distinguishable. These variations, which were often observable in the seeds taken from the single apple, evidently arise from the want of permanence in the characters of this fruit when raised from seed.

"The results of similar experiments on another fruit, the grape, were nearly the same as of those on the apple, except that by mingling the farina of a black and a white grape, just as the blossoms of the latter were expanding, I sometimes obtained plants from the same berry so dissimilar that I had good reason to believe them the produce of superfœtation. By taking off the cups and destroying the immature male parts (as in the pea), I perfectly succeeded in combining the characters of different varieties of this fruit, as far as the changes of form and autumnal tints in the leaves of the offspring will allow me to judge.

Many experiments of the same kind were tried on other plants; but it is sufficient to say that all tended to evince, that improved varieties of every fruit and esculent plant may be obtained by this process, and that nature intended that a sexual intercourse should take place between neighbouring plants of the same species. The probability of this will, I think, be apparent, when we take a view of the variety of methods which nature has taken to disperse the farina, even of these plants in which it has placed the male and female parts within the same empalement. It is often scattered by an elastic exertion of the filaments which support it in the first opening of the blossom, and its excessive lightness renders it capable of being carried to a great distance by the wind. Its position within the blossom is generally well adapted to place it on the bodies of insects, and the villous coat of the numerous family of bees is not less well calculated to carry it. I have frequently observed with great pleasure the dispersion of the farina of some of the grasses, when the sun had just risen in a dewy morning. It seemed to be impelled from the plant with considerable force, and being blue was easily visible, and very strongly resembled in appearance the explosion of a grain of gunpowder. An examination of the structure of the blossoms of many plants, will immediately point out that nature has something more in view than that its own proper males should fecundate each blossom, for the means it employs are always best calculated to answer the intended purpose.

pose. But the farina is often so placed that it can never reach the summit of the pointal, unless by adventitious means; and many trials have convinced me that it has no action on any other part of it. In promoting this sexual intercourse between neighbouring plants of the same species, nature appears to me to have an important purpose in view; for independent of its stimulative power, this intercourse certainly tends to confine within more narrow limits those variations which accidental richness or poverty of soil usually produces. It may be objected by those who admit the existence of vegetable mules, that under this extensive intercourse these must have been more numerous; but my total want of success in many endeavours to produce a single mule plant, makes me much disposed to believe that hybrid plants have been mistaken for mules, and to doubt (with all the deference I feel for the opinions of Linnæus and his illustrious followers) whether nature ever did or ever will permit the production of such a monster. The existence of numerous mules in the animal world between kindred species is allowed, but nature has here guarded against their production, by impelling every animal to seek its proper mate; and amongst the feathered tribe, when, from perversion of appetite, sexual intercourse takes place between those of distinct genera (A), it has in some instances at least rendered the death of the female the inevitable consequence. But in the vegetable world there is not any thing to direct the male to its proper female, its farina is carried by winds and insects to plants of every different genus and species, and it therefore appears to me (as vegetable mules certainly are not common) that nature has not permitted them to exist at all.

"I cannot dismiss this subject, without expressing my regret, that those who have made the science of botany their study should have considered the improvement of those vegetables, which in their cultivated state afford the largest portion of subsistence to mankind and other animals, as little connected with the object of their pursuit. Hence it has happened, that whilst much attention has been paid to the improvement of every species of useful animal, the most valuable esculent plants have been almost wholly neglected. But when the extent of the benefit which would arise to the agriculture of the country, from the possession of varieties of plants, which with the same extent of soil and labour would afford even a small increase of produce, is considered, this subject appears of no inconsiderable importance. The improvement of animals is attended with much expence, and the improved kinds necessarily extend themselves slowly; but a single bushel of improved wheat or peas may in ten years be made to afford seed enough to supply the whole island, and a single apple or other fruit tree may within the same time be extended to every garden in it. These considerations have been the cause of my addressing the foregoing observations to you at this time; for it was much my wish to have ascertained before I wrote to you, whether in any instance a single plant can be the offspring of two male parents. The decision of that question must of necessity have occupied two years, and must therefore be left to the test of future experiment."

February. Fruit Garden.

The opinion Mr Knight endeavours to establish towards the end of his letter, is certainly incorrect, if he means to assert that hybrids can only be produced by a commixture of different varieties of the same species, and that none can be produced by the union of plants of different species. The fact already stated relative to the hybrid produced between the *papav. oriental.* and *somnif.* (two species as different, in every respect, from each other as the horse and ass).

Sect. II. *Fruit Garden.*

96 Pruning of fruit-trees.

Where peaches, nectarines, and apricots, have not been pruned before this, that work ought to be done without delay, because the flower buds after they have begun to swell (which they do at this season) are easily rubbed off. Plums, cherries, apples, pears, gooseberries, currants, and raspberries, &c. may likewise be pruned during this month, if neglected till now.

97 Figs.

About the end of the month you may prune fig trees, as by that time all danger of the young shoots being killed by the frost will be over. As the young shoots of last season alone produce figs the ensuing, a sufficient supply of them must be left to nail on to the wall; and superfluous, ill-placed, very strong long-jointed shoots, and small weak ones, ought to be cut away close to the branch of the former year's growth. The branches which are retained ought to be laid in and nailed to the wall at full length, at the distance of about half a foot from each other. They ought not to be shortened, because the figs are generally produced from that part of the branch near to the extremity: on this account likewise care must be taken, in choosing those which are to be retained, not only to prefer the shoots of moderately vigorous growth, but likewise those which have had least of their extremities killed by the frost, for it frequently happens that the frost kills the succulent extremities of branches, and sometimes even the whole shoot.

Shortening the branches has another bad effect besides removing the part from which the fruit is to proceed, it makes them throw out a crowd of lateral shoots, which create confusion and shade the fruit. All worn-out old branches which are not furnished with a sufficient number of young lateral shoots, ought to be cut away, either close to the main branch from which they proceed, or close to some shoot placed near their lower end. Young fig trees may be planted also any time this month. See October.

98 Plant, &c. strawberries.

Strawberry beds should now receive a dressing. Last year's runners should be cut away, weeds and decayed leaves removed, the ground between the rows dug or loosened with the hoe, and some earth drawn up about the roots of the plants. Strawberries may be planted towards the end of the month: for the method, see June and September.

99 Force early fruit.

Any time this month you may begin to force the trees on hot walls, in vine, peach, and cherry houses, &c.

(A) This is said to be the case with the drake and the hen.

February. Pleasure or Flower Garden.

&c. They ought to be covered with the glasses, some time previous to the application of fire-heat, and if the houses have been constructed with pits for containing hot-beds of tanners bark or horse dung, a quantity of either should be got ready. If tanners bark is to be used, it ought to be spread out and exposed to the air, that it may dry, for if it be put in too wet it will either not heat at all, or heat violently and soon rot, but if properly dried, the heat will be moderate and last for a long time. When horse dung is to be used, it ought to be forked up into a heap and allowed to remain for a few days, during which time it should be turned two or three times with a fork that it may be thoroughly mixed. Slight fires should be applied for two or three days at first, which may be gradually increased. They ought to be kindled about sunset, and supplied with fuel from time to time till about ten o'clock, which will keep the house in a proper heat until morning, when the fires should again be set a going, if the heat has declined, but it will seldom be necessary at this season to keep the fires burning all day. The fuel employed may be either coal, wood, peat, or turf: of these coal is best, because it makes the strongest, the most durable, and most easily managed fire. The heat of each house should be regulated by a thermometer. The degree of warmth kept up at this season, should not much exceed the 60° of Fahrenheit. When the sun shines bright, the heat must be regulated by opening the glasses more or less, and admitting the external air. Besides the trees that may be trained to the wall or front of the house, pots or boxes containing cherry or peach trees may be introduced; likewise pots of kidney beans, strawberries, &c. roses, and a variety of other flowers. The trees and plants within the house must be duly watered, and have plenty of air admitted to them whenever the weather will permit. When the fruit approach to maturity a greater heat should be maintained within the house, which may be effected during the day by the rays of the sun, and sparing admission of the external air, and during the night (if the weather be cold) by fire.

SECT. III. *The Pleasure* or *Flower Garden.*

100 Sow tender annuals.

TOWARDS the end of the month, you may sow some tender annuals, such as balsams, cockscombs, globe amaranthus, ice plants, egg plants, &c. They must be sown in a hot-bed, which is to be formed and earthed over in the same way as seed beds for cucumbers and melons. See JANUARY. The seeds may either be sown in the earth of the bed, or in pots plunged into the earth. Or a few may be sown in pots, and introduced into a cucumber or melon bed. When the plants have acquired sufficient strength to admit of being transplanted, they should be put into separate pots and transferred to other hot-beds. See APRIL.

101 Hardy annuals.

About the end of the month, you may sow some seed of mignionet, ten weeks stock, larkspur, flos Adonis, convolvulus, lupines, scarlet, sweet-scented, and Tangier pea, candytuft, dwarf lychnis, Venus's looking glass, Lobel's catchfly, Venus's navel wort, dwarf poppy, annual sunflower, oriental mallow, lavatera, hawkweed, and many others. They must be sown in places where they are to remain, for none of these plants succeed so well when they are transplanted.

Dig small patches with a trowel in the flower borders, break the earth well, remove part of it from the surface with the edge of the trowel, and sow the seeds, which should be covered with the earth which had been moved aside from the surface of the patches. The smaller seeds, such as mignionet, ten weeks stock, larkspur, &c. should be covered to the depth of about a quarter of an inch; the larger ones, such as lupines, painted and sweet peas, annual sunflower, &c. may be covered to the depth of an inch. After the plants have advanced a little in growth, they should be thinned out in proportion to their size, viz. one sunflower should be left in a place, two plants of lavatera and oriental mallow, four or five of the larger, and six or eight of the smaller lupines, and so on in proportion.

Most kinds of hardy perennials and biennials may be planted out this month, viz. polyanthuses, primroses, London pride, violets, double daisies, double chamomile, saxifrage, rose campion, rockets, campanula, catchfly, scarlet lychnis, double feverfew, bachelor's button, carnations, pinks, sweetwilliam, columbines, monkshood, tree primrose, foxglove, goldenrod, perennial asters, perennial sun-flower, holyhocks, French honeysuckles, wallflowers, and many others.

Where auricula plants are much valued, and where there are many of the finer varieties, they are commonly kept in pots. During mild weather any time this month, it would be proper to give them some fresh earth. Clear away all dead leaves from the plants, remove some of the old earth from the sides of the pot all around, so far as you can do it without injuring the roots, and fill the pots with fresh earth prepared for the purpose. See SEPTEMBER.

Auricula and polyanthus seed may be sown any time this month, either in the open grounds or in pots. When sown in pots or boxes they are more easily moved to proper situations during different seasons. Sow them in light rich earth, and cover them to the depth of about a quarter of an inch. The pots or boxes should be placed in a situation sheltered from the north, and exposed to the morning and mid-day sun, from which they ought to be removed in April to a more shady place. They will be fit for transplanting in the month of June. See JUNE.

About the end of the month plant out the carnations which were raised last year by cuttings or layers, into pots or borders where they are to remain to produce flowers in the ensuing summer.

Any time this month you may transplant evergreen trees, and shrubs; such as pines, firs, evergreen oaks, hollies, yews, cypresses, cedars, phillyreas, arbutuses, laurels, laurustinus, &c.

The finer sorts of tulips, hyacinths, anemones, ranunculuses, &c. should be protected during severe weather, as they begin to appear above ground. For the method of sheltering them, see JANUARY.

Grass walks and lawns ought to be kept clean, poled and rolled at least once a week if the weather permit it. After being rolled with a wooden roller to take off the worm-casts, a heavy stone or iron one should be passed over them to render them firm. Their edges ought likewise to be cut with an edging iron about the end

end of the month, which will give them a neat appearance.

[1]7 W[alk]s and [e]dgings.

Gravel and grass walks may be made during this month: for the latter, see JANUARY, and the former MARCH.

Edgings of boxwood, thrift, daisies, thyme, hyssop, &c. may be planted this month. Boxwood forms the neatest, most durable, and most easily kept edging, and if planted now it will succeed very well. For the method, see OCTOBER. Where any of the old boxwood edgings have become irregular, they ought to be taken up and replanted.

Thrift is frequently employed as an edging, and well kept makes a very neat one. The plants may be either put in with the dibble so close as to touch, or at the distance of two or three inches from each other, or planted as boxwood, see OCTOBER. Daisies are sometimes used, and form a very pretty edging; they may be planted in the same manner as the thrift.

[1]8 Ea[rly] flow[ers] for[ced].

A great variety of flowers, such as hyacinths, jonquils, and roses, &c. may be placed in the hot-house, vinery, or peach-house; and when they have come into flower they may be placed in a green-house, or in apartments of a dwelling house.

SECT. IV. *Nursery.*

MANY things mentioned under the article work to be done in the *nursery* for *January* may likewise be done this month; such as pruning young trees and shrubs, digging between the rows, propagating by cuttings, suckers, and layers, &c. See JANUARY.

La[yers] tra[ns]plan[ted].

Such layers of last year, as appear well rooted, should be removed from the parent plant (or stool), and planted in rows of from one to two feet asunder, according to the size of the plant, and at the distance of a foot or foot and a half from each other in the row.

See[ds] of shru[bs] &c. sow[n].

If seeds or stones of apples, pears, cherries, and plums, were not sown last autumn to raise stocks for budding and ingrafting, they should be sown about the beginning of this month. They should be sown in light soil, and covered to about the depth of an inch. The plants raised from this sowing will be fit for transplanting in the beginning of next winter or spring. The seeds of berries and nuts of shrubs and forest trees may likewise be sown any time this month in narrow beds, and covered in proportion to their size, viz. the small seeds to the depth of about half an inch, the larger to the depth of an inch or an inch and a half, and some of the nuts even to a greater depth.

1[21] and [tran]s-plan[ted].

Trees and shrubs may be removed from the seed-bed or from where they stand too thick, and planted out in rows at proper distances, or transplanted into the places where they are to remain.

1[22] Stock[s] heade[d].

Young trees that were budded successfully last summer should be cut down to within about four inches of the bud. See JUNE and JULY.

1[23] Fruit [tr]ees engra[fte]d.

Pears, plums, and cherries may be ingrafted towards the end of the month, if the weather is mild: apples likewise may be ingrafted at the same time, or in the course of the following month.

Grafting or engrafting, in gardening, is the taking a shoot from one tree, and inserting it into another, in such a manner, that both may unite closely and become one tree.

February. Nursery.

By the ancient writers on husbandry and gardening this operation is called *incision*, to distinguish it from inoculation or budding, which they call *insertion*. Grafting has been practised from the most remote antiquity, but its origin and invention are differently related by naturalists. Theophrastus tells us, that a bird having swallowed a fruit whole, cast it forth into a cleft or cavity of a rotten tree, where, mixing with some of the putrefied parts of the tree, and being washed with the rains, it germinated, and produced within this tree a tree of a different kind. This led the husbandman to certain reflections, from which afterwards arose the art of engrafting.

114 History of engrafting.

Pliny gives a different account of the origin of grafting: he says, a husbandman wishing to make a pallisade in his ground, that it might endure the longer, and with a view to fill up and strengthen the bottom of the pallisade, wattled it with the twigs of ivy. The effect of this was, that the stakes of the pallisades taking root, became engrafted into the twigs, and produced large trees, which suggested to the husbandman the art of engrafting.

The use of grafting is to propagate any desirable sorts of fruit so as to be certain of the variety: for as all good varieties of fruit have been accidentally obtained from seeds, so the seeds of these, when sown, will many of them degenerate, and produce such fruit as is not worth cultivating; but when grafts are taken from such trees as produce good fruit, these will never alter from their kind, whatever be the stock or tree on which they are grafted. Many have supposed that fruit undergoes a change, by being engrafted; but this is not the case. M. Du Hamel tried it on different trees, and for fear of error repeated every experiment several times. He grafted the peach on the almond, the plum on the apricot, the pear upon the apple, the quince on the white thorn, one species of plum on another, and the almond and apricot on the peach. All these succeeded alike; the fruit was never altered; the leaves, the wood, the flowers, were perfectly the same with those of the tree from which the grafts were taken.

Some authors have made mention of engrafting trees of distinct genera on one another; such as the apple on the oak, the elm, the maple, and the plum. M. Du Hamel tried a number of these experiments, none of which proved successful. Engrafting seems never to succeed but when trees of the same natural family are grafted on one another. Some trees are supposed to live longer, and grow more vigorously when engrafted than when growing in a natural state. It is said, that this is the case with the peach, when engrafted on the plum. But it is commonly alleged, that engrafted trees do not live so long as they would have done in their natural state. The reason why engrafted trees are short lived, perhaps proceeds from another cause than merely from the circumstance of being grafted, viz. the age of the tree from which the scions were originally taken.

115 Method of performing it.

The proper tools and other materials used in grafting, are, 1. A strong knife for cutting off the heads of the stocks previous to the insertion of the graft; also a small hand saw for occasional use in cutting off the heads of large stocks. 2. A common grafting knife or sharp pen knife for cutting and shaping the grafts ready for insertion; also to slope and form the stocks for the

February. Nursery.

the reception of the grafts. 3. A flat grafting chisel and small mallet for cleaving large stocks, in cleft grafting, for the reception of the graft. 4. A quantity of new bass strings for bandages for tying the grafted parts close together, to secure the grafts, and promote their speedy union with the stock. And, 5. A quantity of grafting clay for claying closely round the grafts after their insertion and binding, to defend the parts from being dried by the sun and winds, for these parts ought to be closely surrounded with a coat of clay in such a manner as effectually to guard them from all weathers, which would prove injurious to the young grafts, and prevent their junction with the stock.

For this purpose some argillaceous loam or pure clay must be procured, to which should be added one-fourth part of fresh horse dung and a small portion of cut hay. The whole must be well moistened with water, and thoroughly beat with a stick after the manner of mortar.

The scions or grafts (which should be shoots of last year) ought to be selected and cut off some time about the beginning or middle of the mouth. Each kind ought to be put up separately in little bundles, which should be inserted into the earth of a dry border, and should be protected during severe weather by a covering of straw or something of that nature. The reason for taking them off at the time mentioned, is that their growth may be checked, and that they may be preserved in a condition for grafting; for were they to remain on the trees, their buds would begin to swell, and would soon advance so far as to be unfit for using with any prospect of success. The stock intended to be grafted, must, previous to the insertion of the graft, be cut down; those intended for dwarf trees, to be trained on walls or espaliers, must be cut over five or six inches above the ground; those intended for standards should be cut over at the height of five or six feet.

The stocks must vary according to the kinds of fruit to be grafted on them, and to the size of the tree to be produced. Apples are grafted on apple stocks raised from seed, cuttings, or layers; for dwarfs, paradise pippin or Siberian crab stocks are used; for half dwarfs, codlin stocks raised from suckers, cuttings or layers; and for full standards, stocks raised by sowing the seed of crabs or any common apple. Pears are engrafted upon pear stocks obtained from seed or suckers, on quinces, and on white thorn. When they are engrafted on quince stocks, they become dwarf, and are fit for espaliers, &c.

Cherries are engrafted upon cherry stocks obtained by sowing the stones of red or black cherries, and plums are engrafted upon plum stocks raised from seed or suckers (B).

There are different methods of grafting, termed whip-grafting, cleft-grafting, crown-grafting, cheek-grafting, side-grafting, root-grafting, and grafting by approach or inarching; but whip-grafting and cleft-grafting are the most commonly used, and whip-grafting most of all.

February. Nursery. Whip-grafting.

Whip-grafting being the most expeditious and successful method of grafting, is the most commonly practised in all the nurseries; it is always performed upon small stocks, from about the size of a goose-quill to half an inch or a little more or less in diameter, but the nearer the stock and graft approach in size, the better; and is called whip-grafting, because the grafts and stock being nearly of a size, are sloped on one side so as to fit each other, and tied together in the manner of whips or joints of angling rods. &c.; and the method is as follows. Having the scions or grafts, knife, bandages, and clay ready, begin the work by cutting off the head of the stock at some smooth part; this done, cut one side sloping upwards, about an inch and a half or near two inches in length, and making a notch or small slit near the upper part of the slope downwards, about half an inch long, to receive the tongue of the scion; then prepare the scion, cutting it to five or six inches in length, forming the lower end also in a sloping manner, so as exactly to fit the sloped part of the stock, as if cut from the same place, that the bark of both may join evenly in every part, and make a slit so as to form a tongue to fit the slit made in the slope of the stock; then place the graft, inserting the tongue of it into the slit of the stock, applying the parts as evenly and close as possible, and immediately tie the parts close together with a string of bass, passing closely several times round the stock and graft; then clay the whole over near an inch thick all round, from about half an inch or more below the bottom of the graft, to an inch above the top of the stock, finishing the whole coat of clay in a kind of oval form, closing it effectually about the scion, so that neither air nor water may penetrate. The clay must be examined from time to time, for should it crack much, or fall off, a quantity of fresh clay ought to be applied immediately. This sort of grafting may also be performed upon the young shoots of any bearing tree, if you wish to alter the kind of fruit or to have more kinds than one on the same tree. By the middle or latter end of May the graft will be well united with the stock, as will be evident from the shooting of the buds of the graft, when the clay should be removed; but the bass bandage should remain until the united parts seem to swell, and be too much confined, then the bandage should be taken off entirely.

Cleft-grafting.

Cleft-grating is so called because the stock being too large for whip-grafting, is cleft or slit down the middle for the reception of the graft, and is performed in stocks from one to two inches diameter or upwards. First, with a strong knife take off the head of the stock with a sloping cut about an inch and a half long, then cleave the stock with a strong knife or chisel and mallet across the slope to the depth of about two inches, or long enough to admit the graft, leaving the instrument in to keep the cleft open. Prepare the scion by cutting it to such length as to leave four or five eyes, sloping the lower part of it on each side, wedge fashion, to the length of an inch and a half or two inches, making one edge very thin, and leaving the other much thicker with the bark on; then place it in the cleft at the back part

(B) Stocks which are raised from seed, generally grow more freely and vigorously than those raised from cuttings or layers, and on that account are called free stocks.

part of the stock, with the thickest edge outwards to the whole depth of the slope, taking care that the bark of the stock and graft join exactly; when the knife or chisel is removed, each side of the cleft will press on the graft and hold it fast. It must then be bound with a bass bandage and clayed over as in whip-grafting, leaving three or four of the eyes of the scion uncovered.

If large stocks or branches are to be grafted in this way, they must be cut horizontally and smoothed, and may be cleft quite across, and a graft inserted on each side. More clefts indeed than one may be made, and two grafts put in each. This method of grafting may be performed on the branches or stems of old trees, with a view to produce vigorous branches or change the kind of fruit.

Towards the latter end of May or beginning of June the junction of the graft with the stock will be effectually formed, when the clay may be removed, and in a fortnight afterwards the bass bandage may also be taken away.

Crown-grafting.

Crown-grafting is commonly practised upon such stocks as are too large to cleave, and is often performed upon the large branches of apple and pear trees, &c. that already bear fruit, when it is intended to change the sorts, or supply the tree with a number of new vigorous branches. It is termed crown-grafting, because, after the stock or branch has been cut over, several grafts are inserted all around betwixt the wood and bark, so as to produce a crown-like appearance; this kind of grafting should not be performed until March or early in April, for then the sap being in motion renders the bark and wood of the stock much easier to be separated for the admission of the graft. The manner of performing this sort of grafting is as follows: first cut off the head of the stock horizontally, and pare the top smooth; then having the grafts, cut one side of each flat, and somewhat sloping, an inch and a half, forming a sort of shoulder at the top of the slope to rest upon the crown of the stock; after the bark of the stock has been raised by means of a wedge, so as to admit the scion between the bark and the wood, let the scion be thrust down to the shoulder with its cut side next the wood of the stock: in this manner three, four, or more grafts may be inserted into one stock or branch. After the grafts have been inserted, let them be tied tight, and let the clay be applied so as to rise an inch above the top of the stock, taking care to form it so as to prevent the admission of water, which would injure the grafts. Crown-grafting may also be performed by making several clefts in the crown of the stock, and inserting the grafts into the clefts. The grafts will be pretty well united with the stock by the end of May or beginning of June, when the clay and bandage may be taken away. The trees grafted by this method will succeed very well; but for the first two or three years the grafts are liable to be blown out of the stock by violent winds, to prevent which, long sticks must be tied to the stock or branch, to which they may be fixed.

119 Cheek-grafting.

Cheek-grafting is thus executed. Cut the head of the stock off horizontally, and pare the top smooth: then cut one side sloping an inch and a half or two inches deep, and cut the lower part of the graft sloping the same length, making a sort of shoulder at the top of the sloped part; it is then to be placed upon the sloped part of the stock, resting the shoulder upon the crown of it; bind it with bass, and finish it with a covering of clay as in whip-grafting.

120 Side-grafting.

Side-grafting is done by inserting grafts into the sides of the branches without cutting them over, and may be practised upon trees to fill up any vacancy, orfor the purpose of variety, to have several sorts of apples, pears, plums, &c. upon the same tree. It is performed thus. Fix upon such parts of the branches where wood is wanted to furnish the head or part of the tree; there slope off the bark and a little of the wood, and cut the lower end of the grafts to fit the part as near as possible; then join them to the branch and tie them with bass, and clay them over.

121 Root-grafting.

Root-grafting. This is done by whip-grafting scions upon pieces of the root of any tree of the same genus, and planting the root where it is to remain; it will take root, draw nourishment, and feed the graft.

122 Inarching.

Grafting by approach, or inarching, is preferred when the stocks designed to be grafted, and the tree from which the graft is intended to be taken, either grow so near, or can be placed so near together, that the branch or graft may be made to approach the stock, without separating it from the tree till after its union or junction with the stock, so that the branch or graft being bent to the stock they together form a sort of arch, whence it is called grafting by approach, or inarching. It is commonly practised upon such trees as are with difficulty made to succeed by any of the former ways of grafting. When intended to propagate any kind of tree or shrub by this method of grafting; if the tree be hardy enough to grow in the open ground, a proper quantity of young plants for stocks must be set round it, and when grown of a proper height, the work of inarching must be performed; if the branches of the tree you intend to take grafts from be too high for the stocks, in that case the stocks planted in pots, must be placed on a slight stage or some support of that nature, of such a height as to make them reach the branches. Inarching is sometimes performed with the head of the stock cut off, sometimes it is allowed to remain; when the head of the stock is cut off, the work is more easily performed, and is generally more successful, because the stock having no top of its own to support, will transmit all the nourishment taken up by its roots into the graft; when the stocks are properly placed, make the branches approach to them, and mark on the branches the places where they will most easily join to the stock, and in those parts of each branch, pare away the bark and part of the wood two or three inches in length, and in the same manner pare the stock at the proper place; then make a slit upwards in the branch so as to form a sort of tongue, and make a slit downwards in the stock to admit it; let the parts be then joined, sloping the tongue of the graft into the slit of the stock so as to make the whole join in an exact manner; then tie them close together with bass, and afterwards cover the whole with a proper quantity of clay, as before directed in the other methods. After this, let a stout stake be fixed for the support of each graft, to which the stock and graft may be fixed, to prevent their being disjoined by the wind. If this operation be performed in spring, the graft and stock will be united in four months, when the branch may be separated from the parent plant; this should be done cautiously and with a sharp knife, lest the graft should be

February. Nursery.

be shaken and loosened from the stock. If the head of the stock were not removed previous to inarching, it should now be cut off close to the insertion of the graft, and all the old clay and bandages should be taken away and replaced with new, which should be allowed to remain a few weeks longer. If the graft and stock do not seem perfectly united the first autumn after they have been inarched, they should be allowed to stand till next autumn: for were the branch to be cut off from the parent plant before a complete union was formed between it and the stock, the operation would prove abortive.

123 A new method.

An anonymous author has given, in a treatise published at Hamburgh under the title *Amœnitates Hortenses Novæ*, a new method of grafting trees, so as to have very beautiful pyramids of fruit upon them, which will exceed in flavour, beauty, and quantity, all that can otherwise be produced. This he says he had long experienced, and gives the following method of doing it. The trees are to be transplanted in autumn, and all their branches cut off: early in the following summer the young shoots are to be pulled off, and the buds are then to be engrafted into them in an inverted position. This he says, not only adds to the beauty of the pyramids, but also makes the branches more fruitful. These are to be closely connected to the trunk, and are to be fastened with the common ligature; they are to be placed circularly round the tree, three buds in each circle, and these circles at six inches distance from each other. The old trees may be grafted in this manner, the success having been found very good in those of twenty years standing; but the most eligible trees are those which are young, vigorous, and full of juice, and are not above an inch or two thick. When these young trees are transplanted, they must be fenced round with pales to defend them from the violence of the wind. The buds engrafted must be small, that the wounds made in the bark to receive them, not being very large, may heal the sooner; and if the buds do not succeed, which will be perceived in a fortnight, there must be others put in their place. The wound made to receive these buds must be a straight cut, parallel to the horizon, and the piece of bark taken out, must be downwards that the rain may not get in at the wound. In the autumn of the same year this will be a green flourishing pyramid, and the next summer it will flower, and ripen its fruit in autumn.

124 Extreme branch-grafting.

Mr Fairman, of Kent, gives an account of a method of renewing decayed trees, by what he calls extreme branch-grafting, which has been published in the Memoirs of the Society of Arts for 1802. It is addressed to the Secretary.

"Sir,

"From much conversation with Mr Bucknall, on the idea of improving standard fruit trees, we could not but remark that in apple orchards, even in such as are most valuable, some were to be seen that were stinted and barren, which not only occasioned a loss in the production, but made a break in the rows, and spoiled the beauty and uniformity of the plantation.

"To bring these trees into an equal state of bearing, size, and appearance, in a short time, is an object of the greatest importance in the system of orcharding, and also for the recovery of old barren trees, which are fallen into decay, not so much from age as from the sorts of their fruits being of the worn out, and deemed nearly lost, varieties.

"Having long entertained these thoughts, and been by no means inattentive to the accomplishment of the design, I attempted to change their fruits by a new mode of engrafting, and am bold enough to assert that I have most fortunately succeeded in my experiments; working, if I am to be allowed to say it, from the errors of other practitioners, as also from those of my own habits.

"My name having several times appeared in the Transactions of the Society for the Encouragement of Arts, &c.; and having the honour of being a member of that Society, I thought no pains or expence would be too much for the completion of so desirable an improvement. Under these impressions, and having many trees of this description, I made an experiment on three of them in March 1798, each being nearly a hundred years old. They were not decayed in their bodies, and but little in their branches. Two of these were golden pippins, and the other was a golden rennet: each had likewise been past a bearing state for several years. I also followed up the practice on many more the succeeding spring, and that of the last year, to the number of forty at least, in my different plantations (c).

"The attempt has gone so far beyond my utmost expectation, that I beg of you, Sir, to introduce the system to the society for their approbation; and I hope it will deserve the honour of a place in their valuable Transactions.

"I directed the process to be conducted as follows: cut out all the spray wood, and make the tree a perfect skeleton, leaving all the healthy limbs; then clean the branches, and cut the top of each branch off, where it would measure from an inch to two inches in diameter. Some of the branches must of course be taken off, where it is a little larger, and some smaller, to preserve a head or canopy of the tree; and it will be necessary to take out the branches which cross others, and observe the arms are left to fork off; so that no considerable opening is to be perceived when you stand under the tree, but that they may represent a uniform head. I must here remark to the practitioner, when he is preparing the tree as I directed, that he should leave the branches sufficiently long to allow of two or three inches to be taken off by the saw, that all the splintered parts may be removed.

"The trees being thus prepared, put in one or two grafts at the extremity of each branch: and from this circumstance I wish to have the method called *extreme branch grafting*. A cement, hereafter described, must be used instead of clay, and the grafts tied with bass or soft string. As there was a considerable quantity of moss on the bodies and branches of the trees, I ordered my gardener to scrape it off, which is effectually done when they are wet, by a stubbed birch broom. I then ordered

(c) The average expence I calculated at 2s. 6d. each tree.

ordered him to brush them over with coarse oil, which invigorated the growth of the tree, acted as a manure to the bark, and made it expand very evidently; the old cracks were soon, by this operation, rendered invisible.

"All wounds should be perfectly cleaned out, and the medication applied, as described in the Orchardist, p. 14. By the beginning of July the bandages were cut, and the shoots from the grafts shortened, to prevent them from blowing out. I must here, too, observe, that all the shoots, or suckers from the tree, must enjoy the full liberty of growth till the succeeding spring, when the greater part must be taken out, and few but the grafts suffered to remain, except on a branch where the grafts have not taken; in that case leave one or two of the suckers, which will take a graft the second year, and make good the deficiency. This was the whole of the process (D).

"By observing what is here stated, it will appear that the tree remains nearly as large when the operation is finished, as it was before the business began; and this is a most essential circumstance, as no part of the former vegetation is lost, which is in health fit to continue for forming the new tree. It is worthy of notice, that when the vivifying rays of the sun have caused the sap to flow, these grafts, inducing the fluid through the pores to every part of the tree, will occasion innumerable suckers or scions to start through the bark, which, together with the grafts, give such energy to vegetation, that, in the course of the summer, the tree will be actually covered over by a thick foliage, which enforces and quickens the due circulation of sap. These, when combined, fully compel the roots to work for the general benefit of the tree.

"In these experiments, I judged it proper to make choice of grafts from the sorts of fruits which were the most luxuriant in their growth, or any new variety, as described in the 17th and 18th volumes of the Society's Transactions, by which means a greater vigour was excited; and if this observation is attended to, the practitioner will clearly perceive, from the first year's growth, that the grafts would soon starve the suckers which shoot forth below them, if they were suffered to remain. With a view to accomplish this grand object of improvement, I gave much attention, as I have observed before, to the general practice of invigorating old trees; and I happily discovered the error of the common mode of engrafting but a short distance from the trunk or body. There the circumference of the wounds is as large as to require several grafts, which cannot firmly unite and clasp over the stumps, and consequently these wounds lay a foundation for after decay. If that were not the case, yet it so reduces the size of the tree, that it could not recover its former state in many years, and it is dubious if it ever would; whereas, by the method of extreme grafting, the tree will be larger in three or four years, than before the operation was performed. For all the large branches remaining, the tree has nothing to make but fruit-bearing wood; and from the very beautiful verdure it soon acquires, and the symmetry of the tree, no argument is necessary to enforce the practice. Some of the trees, done in this way, yielded each two bushels of apples from the third year's wood.

Cement for Engrafting.

One pound of pitch,
One pound of rosin,
Half a pound of bees-wax,
A quarter of a pound of hog's lard,
A quarter of a pound of turpentine;

to be boiled up together, but not to be used till you can bear your finger in it."

February. Green-house and Hot-house.

Sect. V. *Green-house and Hot-house.*

THE same care of the green-house is required during this month which was recommended in January. If severe frost, or very wet weather prevails, the glasses must be kept close during the day to exclude the frost and damp, or slight fires may be had recourse to for this purpose.

125 Air to be admitted.

In mild weather the glasses must be opened during the day to admit air, and water must be given to the plants regularly, though sparingly. Towards the end of the month it will be proper to remove a little of the earth from the surface and sides of the boxes or pots, and to replace it with some fresh compost. If any of the orange trees, myrtles, or plants of that nature, have irregular heads, they may be cut so as to cause them to throw out a number of new branches to fill up any vacant places, or form an entirely new head. If they require to be much pruned, or to be cut over altogether, it would be proper to shift them at the same time, i. e. to remove them from the box or pot in which they have stood with the ball of earth about their roots, part of which, together with any matted roots, should be pared off from the sides and bottom, and replaced in the boxes and pots, with a proper addition of fresh earth. Any of the plants which are to undergo this operation, that are very sickly, should have almost the whole of the earth removed from their roots, and ought, for some time after shifting, to stand in a bark-bed.

126 Pine stove.

If the bark-bed in the pine stove received no fresh tan or turning last month, it should be examined as early as convenient; and if the heat should have at all declined, it ought immediately to be turned or have an addition of fresh tan, as directed last month. See JANUARY.

If a lively heat be not kept up in the bark-bed now, when the plants shew flower, the size of the future fruit will be considerably affected. A proper degree of warmth, applied to the roots of the plants, will make them grow vigorously and produce large fruit. The heat of the air of the house must be kept at a proper temperature, by due attention to the fires every night and morning, and even during the day in frosty weather, or when cold winds prevail. The bark-bed, in which the succession pine-apple plants grow, should be examined; and if the heat in it begins to decline, it ought

(D) The system succeeds equally well on pear, as also on cherry trees, provided the medication is used to prevent the cherry tree from gumming.

March. Kitchen Garden.

ought to be turned or receive an addition of fresh tan. When the sun shines bright, and the weather is moderate, air must be given by opening some of the glasses. Water should be given regularly both to the pine apple and other plants in the hot-house, bnt much should not be given at a time.

127 Kidney beans to be watered. The kidney beans that were sown last month should receive water frequently. If none were sown last month, some of the early dwarf kinds may be sown now.

128 Cucumbers sown. If no cucumbers were sown last month in the hot-house, some may be sown now; or, plants raised in hot-beds may be introduced, and placed in any convenient situation near the glass.

MARCH.

Sect. I. *Kitchen Garden.*

We need not here give a detailed account of the methods of performing many of the things mentioned under this head, in the two preceding months, though most of them might be performed now with better prospect of success, as this is the principal month in the year for

129 Sow full crops. sowing and planting full crops of the greater part of kitchen-garden vegetables. We shall, therefore, merely enumerate them. Make hot-beds. Sow cucumbers and melons. Transplant and sow cauliflower. Transplant and sow cabbage. Transplant and sow lettuce. Sow spinach, onions, leeks, radishes, carrots, parsnips, beets, beans, peas, turnips, celery, small salad, parsley, salsafy, and Hamburgh parsley. Plant shallot, garlic, scorzonera, and rockambole.

130 Brocoli. Some seed of the early purple and cauliflower brocoli should be sown, both about the beginning and towards the end of the month, in a bed of rich earth, in an open situation, to raise plants to be fit for the table the following autumn. For the subsequent management, see April, May, June, and July.

131 Sea cabbage. The seeds of the sea cabbage (*crambe maritima*) may be sown any time this month, in narrow beds of light earth, about four feet wide, for the convenience of weeding. They may either be sown all over the surface of the bed, tolerably thick, when they are to be transplanted, or in drills a foot and a half or two feet apart, where they are to remain. Those plants are perennial, and every year push up thick succulent shoots. They should be covered some time during the course of the winter, with dry earth, to the depth of a few inches, by which the young shoots, as they come up in spring, are blanched and become fit for use. They should be cut as soon as they appear above ground, or very soon after, in the manner of asparagus.

132 Coleworts. Sow brown and green cole, or bore cole.

Any time in the course of the month some seeds of brown and green cole (kale) may be sown in an open situation, for when they are shaded they are apt to grow up tall and weak. The plants raised now will be fit for planting out in summer, and may be cut for use any time from autumn to spring.

133 Asparagus. About the beginning of this month asparagus seed may be sown in narrow beds of good earth in an open situation. The seed may be scattered regularly all over the surface of the bed, raked in, and then receive a slight covering of earth from the alleys, or in drills, about an inch deep, at the distance of six inches from one another. The plants will appear above ground in four or five weeks, when they ought to be kept clear of weeds and watered occasionally during dry weather. The plants raised now will be fit for transplanting next spring into beds, where they are to remain and produce crops, or into plots, to remain for a year or two till they be fit for forcing.

This a proper season for making plantations of asparagus, for which purpose young plants of one or two years old are commonly used. They succeed best in a deep light soil, and in an exposed situation. The ground should be well manured, dug to the depth of 12 or 15 inches, and divided into beds of the breadth of four feet and a half, in which the asparagus may be planted in rows, 10 or 12 inches apart, and about the same distance from each other in the rows. The usual mode of planting them is to stretch a garden line along the bed, and to form a drill with a spade, to the depth of about six inches, in which the asparagus roots are placed with their crowns or buds uppermost.

A crop of onions may be sown in beds when it is an object to make the most of the ground.

The surface of asparagus beds should be loosened or turned over with a fork, in the course of this month. The instrument commonly made use of for this purpose, is a fork with three flat blunt prongs. Care must be taken not to dig too deep, lest the tops of the asparagus roots should receive injury. Immediately after the surfaces of the beds have been loosened, they should be raked over; for if the raking were to be deferred for some time till the buds of the asparagus approach the surface of the ground, they might be broken by the teeth of the rake. Asparagus beds still continue to produce good crops for 10 or 12 years, if properly managed. They ought not to be cut till the third or fourth year after they have been planted in rich soils; however, a few of the strongest shoots may be cut even in the second, but it should be done sparingly. When asparagus has advanced to the height of three or four inches above ground, it should be collected for the table; but as the shoots are commonly cut about three inches under the surface of the ground, care must be taken not to injure the rising buds (for several buds rise in succession from the same root), for this reason, it is commonly cut with an instrument made on purpose, called an *asparagus knife*, which should be introduced close by the shoot to the requisite depth, and directed so as to cut it off obliquely.

Artichoke plants, that were earthed up during winter to protect them from frost, should now be examined; and if their stems appear to push up vigorously, the earth ought to be removed and levelled. The soil should likewise be loosened from the plants, and if many shoots proceed from the same root, they should all be taken away except three of the strongest. The redundant shoots, if carefully detached from the main roots may be employed to form new plantations; the earth, therefore, should be so far removed as to allow the hand to be introduced to slip them close to their insertion.

Plantations of young artichokes are made towards the end of this or in the course of next month, as soon, indeed, as the offsets (the only way in which this plant is propagated) can be procured. For this purpose choose a plot of good ground, dig in a good quantity of of rotten dung, and plant the offsets with a dibble after their tops and roots have been trimmed a little (if it appear necessary), in rows about four feet and a half asunder, and at the distance of from two to three feet in the rows. A crop of spinach, lettuce, radishes, &c. may be got from the ground the first year, without injuring the artichokes. This plantation will produce heads in September and October, and will continue to produce plentiful crops for six or seven years. Whenever artichokes are required late in the season, young plantations ought to be formed every year, as it is from them alone that heads may be expected late in autumn; for the old plantations generally produce them in June, July, and August. There are two sorts, the large globe, and the French or green oval artichoke; the former is commonly preferred, on account of the size of the head and the quantity of eatable matter they afford.

3 Pot-herbs propagated. Slips or cuttings of sage, rue, rosemary, hyssop, thyme, and savory, may be planted any time this month. They should be planted about six inches apart, and to the depth of nearly two-thirds of their length. By next autumn they will be fit for transplanting.

Sow skirrets. Some seeds of skirrets may be sown in narrow beds, in an open situation, either in drills six inches asunder, or regularly over the surface of the bed. After the plants have come above ground, they should be thinned out to the distance of about six inches from one another, and allowed to remain in the place where sown. This plant is frequently propagated by offsets taken from old roots, which should be planted at the distance of six or eight inches from one another.

Kidney beans. About the end of the month, if the weather be mild and dry, a few early kidney-beans may be sown in a well sheltered situation, at the foot of a wall, having a south exposure. See April. But as these plants are tender, they are liable to be injured by cold weather, therefore a small quantity only should be sown now.

and cardoons. About the middle or latter end of the month some cardoons may be sown for transplanting. For this purpose a piece of light ground should be well dug, the seed sown thinly, and raked in evenly; a few weeks after the plants have come up, they should be thinned out to the distance of about six inches from one another, to allow them room to grow till they are strong enough to be planted out, which will be in June. See June. They may be sown likewise in rows five feet asunder, and at the distance of four feet from each other in the row, and allowed to remain where sown. They are biennial, grow to the height of three or four feet, and are cultivated for the sake of the footstalks of their leaves, which are blanched by being earthed up somewhat in the manner of celery, on which account they require a good deal of room.

14[illegible] Plant chives. This is a proper time to plant chives, a small species of onion, which is used in spring as a substitute for young onions. They grow in large tufts, which are propagated by parting the roots into small tufts containing eight or ten bulbs, which may be planted with the dibble in beds or rows at the distance of six or eight inches from one another.

143 Jerusalem artichokes. You may now plant Jerusalem artichokes, a species of sunflower (*helianthus tuberosa*) the roots of which somewhat resemble the potato, and are to be planted much in the same manner, to the depth of about four inches, in rows three feet apart, and about half that distance from each other in the row. They are fit for the table in October, and continue good all winter and spring.

A full crop of potatoes may be planted any time towards the end of this or in the course of next month. 144 potatoes, Cuttings of moderate-sized potatoes (of the variety intended to be planted), each containing one or two eyes, at least, may be put in with a blunt dibble, to the depth of about four inches, in rows two feet apart, and at the distance of about a foot from each other in the row, or in trenches or holes made with the spade. In the fields they are planted either with the dibble or in furrows made by the plough. See Agriculture. They succeed best in light soil, which should be well manured. After they have come above ground, they ought to be kept clear of weeds, and have a quantity of earth drawn up about their stems. There are many varieties of this vegetable, which are obtained from seed; the principal are, early dwarf, champion, large round white, oblong red and white kidney, common kidney, small white kidney, round red, large round dark red, &c.

Any time in the course of this month new plantations of mint may be formed. 145 and mint, This plant is propagated by parting the roots or by cuttings of the young stalks; the former is practised this month, the latter in next and following month. Procure a quantity of the roots from an old plantation of mint; part and plant them in rows six inches asunder, and about the same distance from each other in the row, either with the dibble, or in drills about an inch deep, drawn by the hoe. These plants succeed very well in any soil, but prefer a moist one. The kinds commonly cultivated are spearmint, peppermint, orangemint, &c.

The leaves and flowers of Indian cresses are frequently used for salads, and their seeds for pickling. 146 Sow Indian cresses. The seeds may be sown about the beginning of the month, at the distance of two or three inches from each other, in drills, about an inch deep. If they are not sown along side of a hedge or other support, they may have sticks placed beside them like peas after they have come above ground. There are two kinds, the large, and dwarf; the former is generally preferred.

Seeds of basil, love apple (or *tomatoes*), and capsicum, 147 basil, &c. may be sown any time this month. They are tender annuals, and must be sown in a hot-bed, to be afterwards planted out in the open ground in May; they must be managed like other tender annuals. See *Flower Garden*. Basil is used in soups and salads, and must be sown in very dry earth, otherwise the seeds will rot. Love apples are used in soups and for pickling. The capsicum, of which there is great variety, is used as a pickle, and for seasoning. The principal kinds are the long-podded, heart-shaped, bell-shaped, angular-podded, round short-podded, cherry-shaped, &c.

Sow cucumbers and melons, to be planted out under hand or bell-glasses. 148 cucumbers and melons.

Some cucumber and melon seed may be sown towards the end of this month, in any of the beds already employed; or one may be formed on purpose to raise plants to be reared under bell or hand-glasses. Those sown now will be fit for ridging out in the beginning of May. See May.

March. Fruit Garden, &c.

Sect. II. *Fruit Garden.*

149 Trees pruned, All kinds of fruit trees mentioned under this head last month may be pruned now, though it ought to be performed as near the beginning of the month as possible; for if the weather has been mild during the preceding month, many of the trees will have advanced too far to be in a state proper for pruning. Figs, however, on account of the late period at which they begin to push, may be safely pruned; indeed this is the best season for pruning them.

150 planted, Fruit trees may still be planted, though the earlier in the month the better; for if mild weather prevails, the buds of the trees will have advanced so far before the end of the month, as to render transplanting less safe. For the method, see October. The duration of the planting season depends more on the mildness and severity of the weather than the time of the year.

151 protected in flower, When apricot, nectarine, and peach trees are in flower, they should be protected during frost with large garden-mats fixed to the top of the walls by hooks, and fastened at the bottom to prevent them from being agitated by the wind so as to dash off the blossoms. These mats must be removed during the mildest part of the day, unless when the weather is very severe, and without sunshine. Instead of mats, old fish-nets doubled may be used for this purpose, and need not be removed during the day; a number of small branches of evergreens (well clad with leaves) fixed amongst the branches of the trees in flower, will also afford shelter to the blossom and setting fruit.

Dress strawberry beds, if not done last month. See February.

152 and forced. Fruit trees on hot walls, in peach, cherry, and vine-houses, must be duly attended to, must receive air and water regularly, and have the fires put on every evening and cold morning.

Sect. III. *Flower Garden and Pleasure Ground.*

153 Transplant early annuals. If any early annuals, such as balsams, cockscombs, &c. were sown last month, they will be fit for planting out into small pots or a hot-bed prepared for the purpose. This hot-bed should be raised to the height of two feet; and when the violent heat has subsided, covered over to the depth of six inches with rich dry earth. The plants may be put in at the distance of three or four inches from one another, or rather in small pots, because from these they can be more easily removed into larger ones at a subsequent period. Due attention must be paid to give them water and air when requisite; and linings of fresh dung must be applied to the bed whenever the heat begins to decline. If properly taken care of, they will be fit for final transplantation in May or June.

If no tender annuals were sown in February, some may be sown any time this month.

Sow less tender or half-hardy annuals, such as China aster, Indian pink, capsicum, French and African marigold, chrysanthemum, tree and purple amaranthus, and Chinese hollyhocks.

154 Sow tender and hardy annuals. Form a slight hot-bed any time this month, which need not be raised higher than two feet, and earth it over to the depth of about six inches. The seed may be sown in narrow drills, at the distance of two or three inches from one another, and each kind, separately or in pots, plunged in the earth of the bed. After the plants have come up, they will require plenty of free air and moderate watering; and when they have acquired the height of two or three inches, they must be gradually hardened to bear the open air, by taking the lights entirely off in mild warm days. Instead of hot-bed frames and lights, oil-paper frames, or hand-glasses, may be made use of. The plants raised now will be fit for transplanting into the flower border in May. If hardy annuals were not sown last month, they may be sown any time during the present.

Cuttings of double chrysanthemums which were planted last autumn in pots or boxes, should be planted out into pots or flower borders if mild weather prevails. Auricula plants in pots should be protected from rain and frost, and should still be kept covered with hooped arches, over which mats may be occasionally thrown, for should they be exposed to much rain or severe weather now when their flower-stalks begin to advance, the future bloom might be injured. Keep the pots clear of weeds, and give them a little water in dry weather, or expose them to a gentle shower. If the pots received no fresh earth last month, let them receive some now. 15[illegible] Management of chrysanthemums and auriculas,

Let the hoops mentioned the two preceding months still continue over the beds of tulips, hyacinths, ranunculus, &c. for if severe weather occurs, the beds must be protected by a covering of mats, as already mentioned. See January. When the stalks of hyacinths, particularly double ones, have advanced almost to their full height, they are apt to be borne down by the weight of their own flowers, therefore a neat small stick ought to be fixed in the ground close to every plant, to which the flowerstalks should be fastened by a piece of brass or other soft ligature. 15[illegible] hyacinths, &c.

Ranunculuses and anemones may still be planted; they will succeed the early ones, and flower in June and July. 15[illegible] ranunculuses and anemones.

Towards the end of the month, seeds of biennial and perennial flowers may be sown, such as carnations, pinks, sweetwilliams, wallflowers, and stock julyflowers of all sorts, also rose campion, catchfly, scarlet lychnis, columbines, Greek valerian, polyanthus, auriculas, scabiouses, and Canterbury bells; likewise hollyhocks, French honeysuckles, rockets, honesty or satin flower, tree primrose, shrubby mallow, broad-leaved campanula, foxglove, snapdragon or frogsmouth, &c. 15[illegible] Sow biennials, &c.

Biennial and perennial plants may likewise be transplanted at this season.

Trees and shrubs, both deciduous and evergreen, may still be planted; but that work should be finished before the end of the month. 15[illegible] Plant trees and shrubs.

Sect. IV. *Nursery.*

Fruit trees, elms, &c. may be engrafted; and the shoots of trees engrafted last year should be so shortened about the time their buds begin to swell, as to leave four or five buds, which will push out branches to form a head. The shoots of last year's growth of trees budded the preceding summer should likewise be shortened, and the heads of trees budded last summer should be cut off about four inches above the bud, which will cause 16[illegible] Ingrafting and treatment of trees budded last year.

ch. ery. cause it to push out vigorously. The part of the stock which is left will serve as a support, to which the young branch may be fixed in the course of the summer, to prevent it from being blown out by the wind.

Sow seeds of trees, &c. Seeds of hardy trees and shrubs may be sown any time this month, in beds three or four feet wide, which should be well dug, and thoroughly pulverized. The seed may be sown either regularly over the surface of the bed or in drills, and covered in proportion to their size; the acorns and other large seeds to the depth of from an inch and a half to two inches, and the smaller ones from about half an inch to an inch. Some of the more delicate shrubs, such as the arbutus, &c. may be sown in pots or boxes, by which means they will be more easily protected from the severity of the weather in winter.

Propagate by cuttings. Most kinds of trees and shrubs may be propagated by cuttings this month, particularly vines.

The vine cuttings must be shoots of last year's growth, about ten or twelve inches long, and each furnished with three buds. If cut from the vines during the winter, before the sap begins to rise, and preserved in dry earth, they will succeed the better. Some leave about an inch of the former year's wood attached to each cutting, but this is unnecessary. They may be planted in rows a foot and a half asunder, and at the distance of eight or ten inches from each other in rows, and so deep as to leave only their uppermost bud above ground; they should afterwards be occasionally watered, and kept clear of weeds. Though cuttings of vines may be raised in the open air, much better plants may be obtained by striking them in a hot-bed or tan-pit in a hot-house. At pruning season select some well-ripened shoots, cut them into pieces of a convenient length, and insert them a little way into pots filled with dry earth, where they may remain till wanted for planting. Protect them in severe, but in mild weather, expose them to the free air. About the beginning of this month, if there is no room in the hot-beds already made, prepare one on purpose, which may be formed and earthed over exactly like a seed-bed for melons. See January. Fill a number of pots, about four inches deep, corresponding to the cuttings you mean to plant, with light rich earth. Take the cuttings you have preserved during the winter; select the roundest and fullest buds; cut the branch about a quarter of an inch above, and about three inches below the bud, with a sharp knife, so as to make a smooth cut; and insert each close by the side of the pot, so deep that the bud may be covered about a quarter of an inch by the earth of the pot; for it is alleged, that a cutting strikes with greater freedom when placed close to the side than in the middle of the pot. When plants are raised in this manner from a single bud, they seem as if reared from seed. As soon as the cuttings are planted, plunge the pots into the earth of the bed, give them a gentle watering, and put on the glasses. Attention must be paid to the bed, to see that the heat be not too strong, for a moderate bottom heat is all that is necessary. Air should be freely admitted during the day, and even during the night, in mild weather; but when the weather is cold, the beds should be covered with mats during the night to protect them from frost. The cuttings should likewise be shaded when the sun shines very bright, with mats, and should receive occasional watering. When the plants are about six or eight inches high they will require to be shifted into larger pots, which must be done cautiously for fear of injuring their roots. Take pots of about six inches deep, and about the same width; put a little good earth into the bottom of each, and turn the cutting out of the small pot into it with the ball of earth as entire as possible, and fill it up with earth. The frames of the beds should be raised in proportion as the plants increase in height, and the heat of the bed renewed by linings of fresh dung when on the decline. Support the shoots when they are about ten or twelve inches high, and pinch off the tendrils and lateral shoots as soon as they appear. They will be fit for planting out in the end of June or beginning of July.

When dry weather prevails, give gentle waterings to seedling trees and shrubs, and keep them free from weeds. 163 Water seedlings.

Sect V. *Green-house and Hot-house.*

The plants in the green-house should receive air freely, unless during wet or frosty weather, and more frequent and plentiful waterings than in the two former months. Dead branches or decayed leaves should be removed, and any of the larger leaved plants that appear foul should have their leaves cleaned with a wet sponge. Those also which require shifting or pruning may be managed as directed last month. Sow seeds and plant cuttings of green-house plants; for which purpose a hot-bed or tan-pit of a hot-house will be necessary at this season. 164 Air to be freely admitted.

Pine apple plants will require a good deal of warmth, particularly in the tan-pit; as their fruit will now be considerably advanced, they must therefore be kept in a vigorous state of growth, to secure large fruit. If the heat of the tan-bed be not very great, at least one-third of new tan ought to be added. After the tan has been procured, it ought to be spread out and dried a little, and then laid up in a heap, in some shed adjacent to the hot-house, till it begin to ferment. The plants should then be taken from the tan-bed, and a quantity of the decayed tan removed from its surface and sides, to make room for the new, which must be thoroughly mixed with the old; and as this operation ought to be completed in the course of one day, a sufficient number of hands should be employed to effect it. Both pine apples and other plants in the hot-house should be regularly watered, and have fresh air admitted in bright calm days, from about two hours before till two or three after noon. 165 Treatment of pine apples.

APRIL.

Sect. I. *Kitchen Garden.*

If the heat begin to decline in the cucumber and melon beds, they should receive linings as directed in the former months; for these plants will not yield fine fruit, or a plentiful crop, if the beds are destitute of a proper heat. Air must be admitted every day, and a moderate watering given ever four or five days, particularly to cucumbers; but melons should receive it sparingly, especially when their fruits are setting, as much water at that time would prove injurious, and make the fruit drop off. Keep the plants clear of all decayed leaves 166 Management of cucumbers and melons.

April. Fruit Garden.

leaves and decayed male flowers. When the sun shines so bright as to cause the leaves of cucumbers and melons to flag, it will be proper to shade them for two or three hours, during its greatest heat, with a thin mat or a little loose hay, strewed thinly over the glasses.

Make hot-beds on which to ridge out cucumbers or melons under hand glasses or oiled paper frames. See May.

167 Plant lettuce, Sow some cabbage, Cilicia, imperial, and large admirable cabbage lettuces any time this month; indeed, some ought to be sown about the beginning, middle, and towards the end of the month, to secure a regular succession. Should the lettuces that were sown last month or in February stand too thick, they may be thinned out and transplanted at the distance of about ten inches from each other, and watered occasionally till they take root.

168 kidney beans. Some early kidney beans, viz. the Battersea, speckled, dun-coloured, and Canterbury dwarfs, may be planted towards the end of the month, in a well-sheltered situation, exposed to the south, in drills two feet or two feet and a half asunder, and about two inches from each other in the drills. The tall running kinds should not be planted till next month.

169 Transplant cabbages, &c. Some of the cabbage and savoy plants, which were sown in February and March, should be thinned and transplanted, when their leaves are about two inches broad, into beds, to gain strength before their final transplantation; and those which have stood the winter may be planted out for good.

170 cauliflowers, Cauliflower plants under bell or hand glasses should have some earth drawn up about their stems, and should be exposed to the open air during the day in good weather. Those sown last month should be planted out into beds in the open air or into slight hot-beds, to forward their growth. Some of the strongest of the plants raised in the early part of spring may be planted out at the end of the month, at the distance of two or two feet and a half each way from one another, and should be occasionally watered till they are well rooted.

171 brocoli, Young plants of brocoli, which were sown last month, may be planted out at the distance of two or three inches from one another, to acquire strength for final transplantation; and some seed of the early purple, late purple, and cauliflower brocoli, may be sown to raise plants for transplanting in June. Some plants of last year's sowing, which produced heads this spring, should be allowed to remain for seed, which will ripen in August.

Sect. II. *Fruit Garden.*

172 Transplant and prune, In late seasons, pear, plum, and cherry trees may still be planted, and even apricot, peach, and nectarine; but it should be done as early in the month as possible, for if any of these have advanced much in growth before they are transplanted, they will not push freely in the course of the summer, and will be liable to be injured by drought. Where pruning has been neglected, it may still be done, but the sooner the better, for many fruit trees will now be in flower.

173 and protect fruit trees, Fruit trees in flower should still be protected in cold weather. See March. All ill-placed shoots should be rubbed off, and the young fruit on apricot trees where set too thick should be thinned.

17[illegible] Dress vines, Look over the vines trained on walls about the end of the month, and rub off the young shoots which proceed from the old wood, unless they happen to be situated where a supply of young wood is wanted; likewise where two shoots proceed from the same eye on branches of last year's growth, let the weakest be rubbed off. Stakes should be placed beside the vines in the vineyard, to which they should be tied, and the ground between the rows should be kept perfectly free from weeds.

17[illegible] History of the vine. The vine was introduced by the Romans into Britain, and appears formerly to have been very common. From the name of vineyard yet adhering to the ruinous sites of our castles and monasteries, there seem to have been few in the country but what had a vineyard. The county of Gloucester is particularly commended by Malmsbury in the twelfth century, as exceeding all the rest of the kingdom in the number and goodness of its vineyards. In the earlier periods of our history the isle of Ely was expressly denominated the *Isle of Vines* by the Normans. Vineyards are frequently noticed in the descriptive accounts of Doomsday; and those of England are even mentioned by Bede as early as the commencement of the eighth century.

Doomsday book exhibits to us a particular proof that wine was made in England during the period preceding the Conquest. And after the Conquest, the bishop of Ely appears to have received at least three or four tuns annually, as tithes from the produce of the vineyards in his diocese, and to have made frequent reservations in his leases of a certain quantity of wine for rent. Dr Thomas, the late dean of Ely, gives the following extracts from the archives of that church.

	L.	*s.*	*d.*
Exitus vineti - - -	2	15	$3\frac{1}{4}$
Ditto vineæ - - -	10	12	$2\frac{1}{2}$
Ten bushels of grapes from the vineyard	0	7	6
Seven dolia musti from the vineyard, 12th Edward II. - - -	15	1	0
Wine sold for - -	1	12	0
Verjuice - - -	1	7	0
One dolium and one pipe filled with new wine, and supposed at Ely. For wine out of this vineyard - -	1	2	2
For verjuice from thence. - -	0	16	0
No wine but verjuice made, 9th Edward IV.			

From these extracts it appears that Ely grapes would sometimes ripen, and the convent made wine of them; and sometimes not, and then they converted them into verjuice. Maddocks in his history of the Exchequer, i. 464. says that the sheriffs of Northamptonshire and Leicestershire, were allowed their account, for the livery of the king's vinedresser at Rockingham, and for necessaries for the vineyard. A piece of land in London, now forming East Smithfield and some adjoining streets, was withheld from the religious house within Aldgate by four successive constables of the Tower in the reigns of Rufus, Henry, and Stephen, and made by them into a vineyard, to their great emolument. In the old accounts of rectorial and vicarial revenues, and in the old registers of ecclesiastical suits concerning them, the

the tithe of wine is an article that frequently occurs in Kent, Surry, and other counties. And the wines of Gloucestershire within a century after the Conquest were little inferior to the French in sweetness. It is alleged that a black grape very similar to the black muscadine was introduced from Gaul into Britain, about the middle of the third century. To these proofs of the antiquity of vineyards in Britain, we shall add the following account of the vineyard at Pains-hill, Surry, (the most extensive one at present in England), given by the original proprietor, the honourable Charles Hamilton, to Sir Edward Barry, and published in his Treatise on Wines, p. 468.

"The vineyard at Pains-hill is situated on the south side of a gentle hill, the soil a gravelly sand: it is planted entirely with two kinds of Burgundy grapes, the Auvernat, which is the most delicate, but the tenderest; and the Miller grape, commonly called the black cluster, which is more hardy. The first year I attempted to make red wine in the usual way, by treading the grapes, then letting them ferment in a vat, till all the husks and impurities formed a thick crust at the top: the boiling ceased, and clear wine was drawn off from the bottom. This essay did not answer; the wine was so very harsh and austere, that I despaired of ever making red wine fit to drink; but through that harshness I perceived a flavour something like that of some small French white wines, which made me hope I should succeed better with white wine. That experiment succeeded far beyond my most sanguine expectation; for the very first year I made white wine, it nearly resembled the flavour of Champagne; and in two or three years more, as the vines grew stronger, to my great amazement my wine had a finer flavour than the best Champagne I ever tasted. The first running was as clear as spirits; the second was œil de perdrix; and both of them sparkled and creamed in the glass like Champagne. It would be endless to mention how many great judges of wine were deceived by my wine, and thought it superior to any Champagne they ever drank; but such is the prejudice of most people against any thing of English growth, I generally found it most prudent not to declare where it grew, till after they had passed their verdict upon it. The surest proof I can give of its excellence is, that I have sold it to wine merchants for fifty guineas a hogshead; and one wine merchant to whom I sold five hundred pounds worth at one time assured me, he sold some of the best of it from 7s. 6d. to 10s. 6d. per bottle. After many years experience, the best method I found of making and managing it was this: I let the grapes hang till they had got all the maturity the season would give them; then they were carefully cut off with scissars, and brought home to the wine barn, in small quantities, to prevent their heating, or pressing one another; then they were all picked off the stalks, and all the mouldy or green ones were discarded, before they were put upon the press; where they were all pressed in a few hours after they were gathered: much would run from them, before the press squeezed them, from their own weight one upon another. This running was as clear as water, and sweet as syrup; and all this of the first pressing, and part of the second continued white; the other pressings grew reddish, and were not mixed with the best. As fast as the wine run from the press into a large receiver, it was put into the hogsheads, and closely bunged up. In a few hours one would hear the fermentation begin, which would soon burst the casks, if not guarded against, by hooping them strongly with iron, and securing them in strong wooden frames, and the heads with wedges. In the height of fermentation, I have frequently seen the wine oozing through the pores of the staves. The hogsheads were left all the depth of winter in the cold barn, to reap the benefit of the frosts. When the fermentation was over, which was easily discovered by the cessation of noise and oozing, but to be more certain, by pegging the cask, when it would be quite clear, then it was racked off into clean hogsheads, and carried to the vaults, before any warmth of weather could raise a second fermentation. In March, the hogsheads were examined; if any were not quite fine, they were fined down with common fish glue in the usual manner; those that were fine of themselves were not fined down, and all were bottled about the end of March; and in about six weeks more would be in perfect order for drinking, and would be in their prime for about one year; but the second year the flavour and sweetness would abate, and would gradually decline, till at last it lost all flavour and sweetness; and some that I kept sixteen years became so like old hock, that it might pass for such to one who was not a perfect connoisseur. The only art I ever used to it, was putting three pounds of white sugarcandy to some of the hogsheads, when the fine was first tunned from the press, in order to conform to a rage that prevailed, to drink none but very sweet Champagne. I am convinced much good wine might be made in many parts of the south of England. Many parts are south of Pains-hill; many soils may be yet fitter for it; and many situations must be so; for mine was much exposed to the south-west wind (the worst of all for vines), and the declivity was rather too steep; yet with these disadvantages it succeeded many years. Indeed the uncertainty of our climate is against it, and many fine crops have been spoiled by May frosts and wet summers; but one good year balances many disappointments."

In a dissertation on the growth of wine in England by F. X. Visper, printed at Bath 1786, there is a method of training vines along the surface of the ground proposed, which seems well adapted to the northerly climate of Britain, for which the Rev. M. L. Broeg obtained a patent. Mr Visper acknowledges that he took the first hint from the following passage, from Lord Chancellor Bacon: "The lowness of the fruit boughs makes the fruit greater, and causes it to ripen better; for we always see in apricots, peaches, and mello-cottons; upon a wall, the largest fruit is towards the bottom; and in France, the grapes that make the wine grow upon low vines bound to small stakes, while the raised vines in arbours make verjuice." He adds "It is reported, that in some places vines are suffered to grow like herbs, spreading upon the ground, and the grapes of these vines are very large; it were proper to try whether plants usually sustained by props, will not bear large leaves and fruit if laid along the ground."

Sect.

April. Flower Garden, or Pleasure Ground, &c.

Sect. III. *The Flower Garden, or Pleasure Ground.*

176 Sow and transplant annuals. Sow and transplant tender annuals. See February and March. Protect hyacinths, ranunculuses, and anemones, planted in beds, from heavy rain and frost, as directed in January and February; likewise, when they are in flower, from very bright sunshine, from about two hours before till two or three after noon; but in this case the covering should be raised to a considerable height, to admit air, and allow them to be viewed.

Plant tuberoses in a hot-bed or hot-house, and give them but little water till they have come above ground.

177 Plant evergreens. Evergreen shrubs and trees may still be planted, but the earlier in the month the better.

178 Walks dressed. Grass walks and lawns should be poled, rolled, and mown. Gravel walks may be broken up and turned.

Sect. IV. *Nursery.*

179 Examine newly engrafted trees. Look over newly engrafted trees, and see if the clay keeps close about the grafts, as it is apt to crack and fall off; when you find it any way defective so as to admit the air and rain to the graft, then remove it and apply fresh clay in its stead. All shoots which rise from the stalk below the graft must be taken off whenever they are produced; for if permitted to remain, they would rob the graft of nourishment, and prevent it shooting freely.

180 Those budded last year. Trees that were budded last year, will now begin to push out their first shoots. Should they be infested with insects, so as to cause any of their leaves to curl, these should be picked off, and pains taken to destroy the vermin. Shoots that proceed from the stock under the bud must be rubbed off as soon as they appear.

181 And transplant young ones. The sowing and transplanting of young trees and shrubs from the seed-bed, or where they stand too thick, should be finished early in the month, and if very dry weather prevail, water should be given to seed-beds, cuttings, and lately transplanted trees and shrubs.

Sect. V. *Green-house and Hot-house.*

Air may be admitted, and water given more freely than in the former months, because the plants will begin now to advance in growth; but in general the management must be nearly the same as recommended last month.

182 Requisite heat for pine apples. A proper degree of warmth, both in the bark bed and in the air of the hot-house, is requisite for fruiting pine apple plants. Water may be more frequently given, and air admitted more freely, because the weather will be milder; and in other respects they must be managed as directed in March. The succession pine apple plants, or such as are to fruit next year, should be shifted into larger pots, (viz. 24s.) the size commonly made use of. When the plants are healthy, they should be turned out of the pots with the ball of earth about their roots as entire as possible, and put them into larger ones with an additional quantity of fresh earth; but should the plants be sickly, infested with insects, or appear to have bad roots, the whole of the earth should be shaken off, and the roots trimmed, a few of the under leaves stripped off the stem, and the plants then put into pots filled entirely with fresh earth.

After the plants have been thus shifted, they should have a moderate quantity of water given them frequently, which will promote their growth. The young pine apple plants which were raised from suckers or crowns last season should likewise be shifted into larger pots, if their roots appear to have filled those in which they have stood during the winter: if healthy, they should be turned out of the pots with the ball of earth entire; if otherwise, they must be treated like the succession plants as above.

1[illegible] Propa[gate] hot-h[ouse] plant[s]. This is a proper season for propagating hot-house plants by cuttings, layers, &c. or for sowing their seeds. Cuttings of green-house plants may likewise be struck in the bark bed of the hot-house, and kept there till fit for transplanting.

MAY.

M[ay.] Kit[chen] Gar[den.]

Sect. I. *Kitchen Garden.*

1[illegible] Treat[ment] of me[lons] &c. Melons require attention, particularly when their fruit are setting. The heat of the hot-beds must be kept up by proper linings; water must be given moderately, and air admitted regularly. In warm weather when the sun shines bright, the plants should be shaded from its rays for an hour or two about midday, by a covering of mats or something of that nature. A piece of tile or slate should be placed under each fruit after it is set, to prevent it from coming into contact with the moist earth of the bed, which would injure it, and cause it to drop off. Ridges may be formed for the reception of the melon and cucumber plants, which were sown last or preceding month, to be raised under hand or bell glasses. These ridges should be about four feet wide, and are to be constructed in the same manner as hot-beds. See January. The dung should be raised to the height of two feet and a half, and covered with six or eight inches of rich light earth, and may be made either in trenches about a foot deep or on the surface of the ground. When more than one ridge is to be constructed, they should be placed parallel to one another at the distance of about four feet, which interval should afterwards be filled up with fresh horse dung when the heat in the ridges begins to decline; this will both revive the heat, and when earthed over, will afford room to extend the advancing runners of the plants. As soon as the ridges are earthed over, the hand or bell glasses may be put on along the middle of the bed, at the distance of four feet, when intended for melons, and three feet when for cucumbers; and the following day, or as soon after as the earth under the glasses has become warm, a hole should be made under each, into which two melon or three cucumber plants are to be put with the ball of earth about their roots; the earth should then be well closed about the ball and stem of the plant, a little water given, and the glasses put on. Shade them for a day or two, and give air during the day by raising the glasses. When the plants have filled the glasses, the runners must be trained out from under them, but this should not take place till the end of the month, or some time in June. Oil paper frames are sometimes used for covering the ridges. These frames

frames are made of thin slips of wood covered with paper, rendered transparent and water proof by means of oil. Melons reared in this way will produce plentifully in August and September, and cucumbers from the middle of June, till the cold weather in autumn set in. If no cucumber plants were raised in March or April for this purpose, some seeds may be sown in the ridges. Some may likewise be sown about the end of the month in the open ground, to produce a crop for pickling; but should cold weather prevail at that time, it should be deferred till June. Gourds and pumpkins may be sown in the open ground in a warm situation, or in a hot-bed, to be afterwards transplanted.

A full crop of kidney beans may be planted both of the dwarf and tall running sorts: the former, viz. black speckled, Battersey and Canterbury white, should be planted in drills about an inch deep, and two feet and a half asunder, at the distance of two or three inches from each other; the latter, viz. the scarlet and large Dutch white, should be sown in drills, about an inch and a half deep, and three feet and a half or four asunder. These running kinds must have tall sticks, or some support of that nature.

The capsicum and love apples which were raised last or the preceding month in hot-beds, may be planted out into well sheltered situations exposed to the south.

Some spinach plants, both of the smooth and prickly seeded, should be allowed to run up for seed; and some of the different kinds of radishes should be transplanted for the same purpose.

The different crops should be kept clear of weeds, and thinned with the hoe. Turnips may be left at the distance of seven or eight inches from each other; carrots, six or eight; parsnips, eight to ten or twelve; onions, four or five; Hamburgh parsley, scorzonera, and salsafy, six or seven; and cardoons, five or six; that they may acquire strength for final transplantation.

Plant out cabbages, savoys, cauliflower, brocoli, and bore-cole.

Sect. II. *Fruit Garden.*

As wall trees will now have made vigorous shoots, a sufficient quantity of the best placed lateral, and all the terminal ones, should be trained to the wall, and all foreright, ill placed, superfluous, and very luxuriant shoots, should be removed. None of the young branches should be shortened, unless where a supply of new wood is wanted to fill up some vacant space. When the fruit stands too thick on wall trees, they should be thinned. When wall trees are infested with insects, means should be made use of to destroy them; the curled leaves should be picked off with a view to check their propagation: tobacco dust may be sometimes employed with advantage; but water sprinkled plentifully over the branches with an engine constructed on purpose, is the most efficacious remedy.

Let vines both on walls and in vineyards be looked over; and let all superfluous branches, which proceed from the old wood or lateral shoots, which are pushed out by the young branches, be rubbed off; indeed this must be done constantly during the summer.

Sect. III. *The Flower Garden, or Pleasure Ground.* June. Kitchen Garden.

Tender annuals should be transplanted into newly formed hot-beds, when they are wished to flower early and in full perfection, particularly balsams and cockscombs. 192 Transplant tender annuals into hot-beds.

Let the auricula plants in pots, which are past flower, be placed in some situation where they may enjoy some free air and the sun till about ten o'clock in the morning. 193 Treatment of auriculas.

Some wallflower and stock gilliflower seed may be sown about the beginning of the month; cuttings also of double wall-flowers and stocks may be planted under bell and hand glasses, or in a shady border. 194 Sow wall-flower, &c.

Perennial and biennial plants that were sown last March, will be fit for transplanting about the end of the month into beds, where they may remain to acquire strength. 195 Transplant biennials, &c.

Sect. IV. *Nursery.*

Towards the end of the month, the clay should be removed from newly grafted trees, and the bandages loosened, because they might check the growth of the grafts, which will now shoot freely; and all buds under the graft should be carefully removed. 196 Newly grafted trees.

Sect. V. *Green-house and Hot-house.*

About the end of the month, if the weather should be favourable, the greater part of the plants may be removed from the green-house, and placed in some well-sheltered situation in the open air. The plants in the hot-house should receive water and air freely, particularly in bright weather. 197 Plants to be removed into open air.

JUNE.

Sect. I. *Kitchen Garden.*

The same care of cucumbers and melons which was recommended for last month, is necessary now; the cucumbers sown in the open ground last month should be thinned, when they begin to push out their first rough leaves, and a few more seeds may be sown for the same purpose, but the earlier in the month the better. 198 Melons, &c.

Transplant celery for blanching. For this purpose, form trenches, about a spade deep and three feet apart; lay the earth which comes out of the trenches regularly along each side; lay into each trench some well rotten dung, and dig it in: put the plants in a row along the middle of the trench at the distance of four or five inches from one another. About a month or six weeks after they have been planted, when they have acquired the height of six or eight inches, a quantity of earth should be laid about their stems, to blanch them and prepare them for the table; this should be done during dry weather, and repeated once a fortnight, or according as the plants advance in growth, till they are blanched to the height of a foot or fifteen inches. The earlier sown celery will be fit for transplanting about the beginning of the month; the later sown, about the end.

About the latter end of the month transplant endive for

June. Fruit Garden, &c.

for blanching; which should be planted out in rows, a foot apart, and at the same distance from one another in the row. Some endive seed should be sown for a principal crop; the green curled is commonly sown for this purpose, because it is least apt to be injured by rain or cold.

199 Endive blanched.

200 Cauliflowers, &c. planted out.

The cauliflower, brocoli, and bore-cole plants which were sown last month, should be planted out at the distance of about three inches from one another, into beds where they may remain, to acquire strength to fit them for final transplantation in July. Some of the early cauliflower plants, which have formed good heads, should be allowed to stand for seed, which will ripen in September.

201 Sow turnips.

About the middle of this month is the best season for sowing a principal crop of turnips; the different kinds commonly sown, are the yellow, white Dutch, round white, stone-turnip, Swedish, black Russian, small French round. The large white Norfolk, green topped, and red-topped, are chiefly used for field culture.

202 Plant out leeks,

Plant out leeks in rows nine inches asunder, and about six inches from one another in the row; it is an usual practice to trim off the extremities of their leaves and of their roots before they are planted.

203 and pot-herbs,

Plant out pot-herbs, such as thyme, savory, sweet-marjoram and hyssop; likewise angelica, marygolds, clary, &c. A rainy or dull day should be chosen, and the plants put in at the distance of six inches from one another; occasional watering will be necessary, till they have taken root. Cuttings or slips of sage, hyssop, rue, rosemary, lavender, &c. may be planted in a shady situation, and occasionally watered.

Sect. II. *Fruit Garden.*

204 Strawberry plants prepared.

Wall trees, and vines in the vineyard, require the same attention this month that was recommended last. When plantations of strawberries are wanted, the young plants that are produced at the joints of the runners, that are furnished with good roots, should be taken up about the end of this month, and planted in a shady border at the distance of about six inches from one another; by September they will be fit to be planted out at the distance of a foot or fifteen inches from each other.

Sect. III. *Flower Garden, or Pleasure Ground.*

205 Bulbous roots, &c. taken up.

The roots of hyacinths, jonquils, ranunculuses, &c. should be taken up after their stalks begin to decay, dried and preserved till planting season; the roots of narcissus, crocus, snow-drop, &c. may likewise be taken up and separated, and either planted again immediately or kept till autumn.

Take up also autumnal flowering bulbs, such as colchicum, autumnal crocuses and narcissus, Guernsey and belladona lilies, cyclamens, &c.; take off the offsets, and plant them again immediately, or keep them till next month.

206 Propagate perennial plants.

Perennial plants, such as double scarlet lychnis, double rocket, &c. may be propagated by cuttings of their stalks; each cutting should consist of three or four joints, two of which, (or more than one half the length of the cutting), should be inserted into the ground; they may be either planted into a shady border, three or four inches apart, or more closely together, and covered with bell or hand glasses.

Propagate carnations, pinks, and double sweet-williams, by layers. Select young shoots about five or six inches long for this purpose; strip off the leaves from the lower part of the stalks, and trim off the tops of those placed at its extremity; make a slanting cut with a sharp knife on the under part of the stalk, which should commence at a joint near the middle of the shoot, and extend upwards almost half way to the next; make a hole in the earth about an inch or an inch and a half deep, immediately under the shoot, for its reception; fix it down with a small hooked stick, and cover it with earth, except an inch or two at its extremity. A little water should be given in dry weather, which will make the layers strike root more readily. Pinks and carnations may likewise be propagated by cuttings or pipings. These pipings are formed of the extremities of the young shoots, taken off immediately under the third joint, which should be inserted into light earth almost to their tops, (the extremities of their leaves being previously trimmed off). They should receive a little water to make the earth settle closely about them, and should be covered with a bell or hand glass. The earth is sometimes rendered quite wet, and reduced to a state resembling mortar, before the pipings are introduced.

About the end of the month hedges should receive their first clipping.

Sect. IV. *Nursery.*

About the end of the month you may inoculate peaches, nectarines, apricots, and roses: for the method, see July.

If any of the trees that were budded last summer, or engrafted last spring, have made very vigorous shoots, stakes should be fixed into the ground close to the stocks, to which both the stocks and shoots must be fixed.

Propagate both deciduous and evergreen shrubs by layers, particularly such as do not push out roots freely except from the new wood.

Sect. V. *Green-house and Hot-house.*

If the green-house plants were not placed in the open air last month, on account of the coldness of the weather, they may be safely trusted out now. These plants may be propagated this month by cuttings, layers, inarching, &c.

Hot-house plants may likewise be propagated now, and should receive a plentiful allowance of air and water; pine apple plants which are approaching to maturity should be sparingly watered, because too much water would injure the flavour of the fruit.

JULY.

Sect. I. *Kitchen Garden.*

Plant out cabbages, savoys, brocoli, bore-cole, endive and celery; for the methods see the former months. Sow some brocali seed about the beginning of the month. Sow some endive seed for a winter crop; the green curled endive is the best for this purpose, but some

some white and Batavian may likewise be sown. Some kidney-beans, of the dwarf kind, should be sown for a late crop. Some turnip-rooted or Spanish radish may be sown, and managed exactly like turnip: there are two kinds, the black and the white; both of which are very hardy, and stand the winter well.

1 Late crops of p[eas]. Some peas and beans may be sown when a late crop is wanted.

As artichokes now advance to maturity, those who prefer one large head to two or three smaller ones, ought to cut off all the lateral heads from the stalks, before they exceed the size of a hen's egg; which will promote the growth of the principal head. It is a common practice to break down the stalks of artichokes near the ground, as soon as their heads have been cut for the table, to make them push more vigorously from the root.

If the stalks of onions, garlick, and shallot, begin to decay, which is sometimes the case about the end of this month, they should be pulled up and dried. See AUGUST.

SECT. II. *Fruit Garden.*

2 Fruit protected. As fruits advance to maturity, wall trees should be protected from birds by nets; and means should be taken to destroy snails, wasps, and other insects.

SECT. III. *Flower Garden, or Pleasure Ground.*

2 Plant out annuals. SOME tender annuals may be planted out into the flower borders in the open air.

2 And auriculas, &c. Seedling auriculas and polyanthuses may be planted out, into a border not exposed to the mid-day sun, at the distance of two inches from one another, and watered occasionally.

SECT. IV. *Nursery.*

INOCULATE apricots, peaches, nectarines, plums, and pears; the first four are commonly inoculated on plum stocks, the last on pear or quince stocks. Inoculating or budding, as it is termed, may be performed on many other trees, and shrubs; the method of performing it is as follows.

21 Method of inoculation. With a budding knife, which resembles a penknife with a flat handle, make a horizontal cut at some smooth part quite through the bark of the stock, from the middle of which make a perpendicular cut downwards, about two inches in length, so as to form a figure resembling the letter T. Take a young shoot of the tree, with which you intend to inoculate, cut off the leaves from its lower extremity, leaving a small part of the footstalk of each; then, about an inch under the lowest bud, make a cross cut in the shoot almost halfway through, with the knife slanting upwards, and with a clean cut, bring it out about half an inch above the bud, detaching part both of the wood and bark containing the bud. Separate the small piece of the wood which was taken off along with the bud, from the bark, which is readily done with your knife, placing the point of it between the bark and wood at one end; then examine the inside of the bark, to see if the internal end of the bud be left; for if there appears a small hole, the eye is gone with the wood, and the bud becomes useless; but if no hole appears, the bud is good, and may be inserted into the stock, by raising the bark with the hand of the budding knife on each side of the perpendicular cut, immediately under the cross cut. If the piece of bark which contains the bud be too long for the incision made in the stock, it should be reduced to a proper length with the knife, and introduced between the bark and wood of the stock, and placed so as to make the bud project through the perpendicular cut. Having fixed the bud, and placed the bark of the stock closely above it, put a bandage of mat, which should be previously steeped in water to increase its tenacity, round the stock, which should extend from a little below to a little above the incision; taking care that none of the folds of the bandage cover the bud.

July. Green-House and Hot-House.

In three weeks or a month after the inoculation has been performed, the buds will have united with the stock, which is discoverable by the bud appearing plump; the bandages should then be removed: were they to remain, they would cramp the buds and injure them. The incisions should be made in the stocks about six inches above ground, when dwarf trees are wanted; and at the height of six feet, when standards are to be inoculated: the buds remain dormant, and require no further attention till next spring; when they begin to push out, the heads of the stalks should be cut off.

Seedling pines, where they stand too thick in the seed-bed, may be transplanted; but great care must be taken to water them and shade them from the sun. 216 Seedling pines transplanted.

SECT. V. *Green-House and Hot-House.*

GREEN-HOUSE plants require a plentiful supply of water at this season. If the fruit have set too thick on orange or lemon trees, they should be thinned, otherwise they will not acquire a proper size. 217 Thin the fruit of oranges.

As many of the pines will ripen their fruit in the course of this month, it is a proper time to begin to propagate these plants, which is done by planting the crowns that are produced at the top of the fruit, and the suckers which proceed from the root of the plants, about the time the fruit is ripe, or soon after they are cut. 218 Propagate pine apples.

These suckers or crowns, if properly managed, will produce fruit in two years, and then decay. Each fruit is surmounted by at least one crown, which frequently has a number of offsets at its base; and each plant, after it has produced fruit, throws out from its root one or more suckers before it decays. The crowns, when they are separated from the fruit, must lie five or six days in some dry place, till the part which was attached to the fruit is completely dried, before they are fit for planting. The suckers which proceed from the root of the plant should be taken off, when they have acquired the length of five or six inches, and when their lower extremity has become brown; they must likewise lie in some dry situation for a few days, till the part by which they were connected with the root of the parent plant be thoroughly dried. Put each crown or sucker into a small pot, filled with light rich earth, and plunge them in the bark-bed of a hot-house, or in a hot-bed made on purpose.

A method of raising pine apples in water is given by William Bastard, Esq. of Devonshire, in the 67th volume 219 Method of raising pines in water.

July. Green-house and Hot-house.

lume of the Philosophical Transactions. His account of this method is as follows:

"In the front part of the house, and indeed anywhere in the lowest parts of it, the pine-apple plants will not thrive well in water. The way in which I treat them is as follows:—I place a shelf near the highest part of the back wall, so that the pine apples may stand without absolutely touching, but as near it as can be; on this shelf I place pans full of water, about seven or eight inches deep; and in these pans I put the pine-apple plants, growing in the same pots of earth as they are generally planted in, to be plunged into the bark-bed in the common way; that is, I put the pot of earth, with the pine plant in it, in the pan full of water, and as the water decreases I constantly fill up the pan. I place either plants in fruit, or young plants, as soon as they are well rooted, in these pans of water, and find they thrive equally well: the fruit reared this way is always much larger, as well as better flavoured, than when ripened in the bark-bed. I have more than once put only the plants themselves without any earth, I mean after they had roots, into these pans of water, with only water sufficient to keep the roots always covered, and found them flourish beyond expectation. In my house the shelf I mention is supported by irons from the top; and there is an intervening space of about 10 inches between the back wall and the shelf. A neighbour of mine has placed a leaden cistern upon the top of the back flue, in which, as it is in contact with the flue, the water is always warm when there is fire in the house, and finds his fruit excellent and large. My shelf does not touch the back flue, but is about a foot above it; and, consequently, the water is only warmed by the air in the house. Both these methods do well. The way I account for this success is, that the warm air, always ascending to the part where the shelf is placed, as being the highest part of the house, keeps it much hotter than in any other part. The temperature at that place is, I believe, seldom less than what is indicated by the 73° of Fahrenheit's thermometer, and when the sun shines it is often above 100°: the water the plants grow in seems to enable them to bear the greatest heat, if sufficient air be allowed; and I often see the roots of plants growing out of the holes in the bottom of the pot of earth, and shooting vigorously in the water.

"My hot-house, the dimensions of which it may be proper to know, is 60 feet long, and 11 feet wide, the flues included; six feet high in the front, and 11 feet at the back of the inside of the house. It is warmed by two fires. A leaden trough or cistern on the top of the back flue is preferable to my shelf; as in it the pine plants grow much faster in the winter, the water being always warmed by the flue. Of this I have seen great benefits these last two months in my neighbourhood.

"It is not foreign to this purpose to mention, that as a person was moving a large pine plant from the hot-bed in my house last summer, which plant was just shewing fruit, by some accident he broke off the plant just above the earth in which it grew, and there was no root whatever left to it. By way of experiment, I took the plant, and fixed it upright in a pan of water, without any earth whatever, in the shelf; it there soon threw out roots, and bore a pine apple that weighed upwards of two pounds."

1. The *bromelia ananas*, of which there are six varieties: 1. *Ovatus*, or oval-shaped pine apple. 2. *Pyramidalis* (pyramidal), or sugar-loaf pine. 3. *Glaber*, with smooth leaves. 4. *Lucidus*, with shining green leaves. 5. *Serotinus*, with a yellowish-coloured flesh. 6. *Viridis*, or green pine apple.

Varieties of the pine apple.

The first sort of ananas is the most common in Europe; but the second sort is much preferable to it, the fruit of this being larger and much better flavoured: the juice of this sort is not so astringent as that of the first; so that this fruit may be eaten in greater quantity, with less danger. This sort frequently produces suckers immediately under the fruit, whereby it may be increased much better than the common sort; so that in a few years it may be the best common sort in Britain.

The third sort is preserved for curiosity by way of variety; but the fruit is not worth any thing.

The sort with very smooth green leaves, was raised from seeds taken out of a rotten fruit, which came from the West Indies to the late Henry Heathcote, Esq. from whom Mr Miller received one plant, which produced large fruit: this is what the people of America call the *king pine*.

AUGUST.

Sect. I. *Kitchen Garden.*

Sow some prickly-seeded, or triangular-leaved spinach, for a winter and spring crop; for though the round-seeded produces larger and more succulent leaves, the prickly-seeded is to be preferred now, because it is by much the hardier of the two. After the plants have got their first leaves about an inch broad, they should be thinned to the distance of four inches from one another, and kept free from weeds.

Sow winter crops of spinach.

Sow some cabbage seed, both of the early and late kinds, to produce plants for next year.

Cabbages.

Sow some onions, to be used when young in winter or spring, or to produce a crop of early onions this summer. The Strasburgh or any other kind may be sown now, but the Welsh onion is very hardy, and stands the winter well; for though their tops should be destroyed by the severity of the weather, they will push up again from the root in the spring: this onion, however, does not produce bulbs.

Onions.

Towards the end of the month sow some cauliflower seed to produce plants for an early crop next summer, which may be protected during the winter, either under hot-bed frames, bell or hand-glasses, or in a well-sheltered border exposed to the south. Between the 18th and 24th of this month is, perhaps, the best time to sow these seeds. The London gardeners, who sow great quantities, are accustomed to sow them on a particular day, viz. the 21st of this month. If they be sown too early, they are apt to button, as the gardeners term it, i. e. run up to seed without producing heads of a proper size; and if they be sown too late, the plants do not acquire sufficient strength, before winter, to enable them to support the severity of the weather.

Cauliflowers.

Sow some lettuce seed about the middle of the month, both to supply the table late in the autumn, or beginning of winter, and to plant out into well-sheltered borders, or under hot-bed frames, to stand during winter.

Lettuce.

Plant out brocoli, savoys, bore-cole, and celery, for the use of winter and spring.

The cardoons which were planted in June should have some earth laid up to their stems, to blanch them and render them fit for the table. That this may be accomplished the more easily, tie up the leaves of each plant, with a piece of bass mat or small straw rope, and apply some earth close round the stem, which earthing must be repeated at intervals, till it rise to the height of two feet.

The principal crops of onions will be fit for taking up in the course of this month. Choose a dry day for taking them up; take off the stalks within two or three inches of the bulb; spread them in some dry place, exposed to the sunshine, for 10 or 12 days, that they may be thoroughly dried.

Sect. II. *Fruit Garden.*

Look over vines, figs, and other wall trees; remove all foreright and superfluous branches, and nail the others close into the wall, that the rays of the sun may have free access to the fruit.

Vines in the vineyard likewise should be fixed to the stakes, and cleared of all superfluous shoots.

Sect. III. *Flower Garden*, or *Pleasure Ground.*

About the end of the month, you may propagate by slips, fibrous-rooted perennial plants, such as double rose campion, catchfly, double scarlet lychnis, double rocket, double ragged robin, bachelors button, gentianella, polyanthuses, auriculas, double daisies, &c. As these plants frequently grow in tufts, they may be taken up and divided, taking care that every slip be provided with some roots.

Auricula plants in pots should receive fresh earth.

Auricula and polyanthus seed may be sown any time this month, but will not come up till spring.

Layers of carnations, double sweetwilliams, and pinks, that are properly rooted, may be separated from the parent plant, and planted into borders or pots. Cuttings and pipings of pinks and carnations, may be planted out into beds or borders.

Towards the end of the month the seeds of bulbous-rooted flowers, such as tulips, hyacinths, narcissus, iris, crocus, fritillaria, crown imperial, lilies, and snowdrops; likewise, the seeds of anemone, ranunculus, and cyclamen, may be sown in beds or boxes, to obtain new varieties. They must be protected during winter from frost; and when they appear above ground in spring, they must be kept clear of weeds.

Plant out seedling biennials and perennials.

About the end of this month hedges should receive their second clipping.

Sect. IV. *Nursery.*

234 Budding may still be performed about the beginning of the month, and those trees which were budded three weeks or a month ago, should be examined. If the buds remain plump and fresh, there is reason to believe that they have succeeded; in that case the bandages must be loosened.

Sect. V. *Green-house and Hot-house.*

Green-house plants, in the open air, must be managed as already directed.

The plants in the hot-house must receive a plentiful allowance of air and water.

Succession pine-apple plants, that are to produce fruit next year, should be shifted into larger pots, viz. twenty-fours or sixteens, about the beginning of the month. The plants should be turned out of the old pots and placed in the new ones, a quantity of light rich earth being previously put into the bottom of each. Each pot should then be filled with some of the same earth, watered, and plunged into the tan, which, at the same time, should be turned over and receive an addition of about one-third of fresh tan.

SEPTEMBER.

Sect. I. *Kitchen Garden.*

Plant some brown Dutch, cos, and common cabbage lettuce, in a well-sheltered situation, exposed to the mid-day sun, to be covered with hot-bed frames and glasses, which should not be put over them till some time next month. 235 Plant out lettuce.

Plant out from the seed-bed the cauliflowers that were sown last month, into well-sheltered borders, at the distance of three or four inches from one another, taking care not to plant them so deep as to cover their hearts with earth. These plants may be either planted out again next month under garden frames, bell or hand-glasses to stand during the winter, or may remain where planted. 236 Cauliflowers.

Plant brocoli, savoys, bore-cole, celery, and endive. 237 Brocoli, &c.

Earth up celery and cardoons.

Tie up the leaves of endive with a piece of bass mat, or something of that nature, to blanch them, and prepare them for the table.

Mushroom beds may be formed any time this month, as spawn will very easily be procured during August, September, or October. The spawn has the appearance of a white mould shooting out in strings, which, when bruised, smells like mushrooms. It may be obtained either from old mushroom beds, old hot-beds, or dung hills that are principally composed of horse dung, and from pasture fields, indeed in any place where horse or sheep's dung has lain for some time undisturbed and not exposed to much moisture; and may be preserved for a considerable length of time, in a proper state for using. If spawn is not otherwise to be procured, some may be produced by laying a quantity of horse-dung and rich earth in alternate layers, and covered with straw to exclude the rain and air; for the more these are excluded, the sooner the spawn will appear, which commonly happens in about two months after the dung and earth have been laid together. Mushroom beds should be formed of dung that has been spread out for some time, without having been fermented, and may be made two or three feet broad, and of any length. A stratum of dung about a foot thick, should be laid first, which should be covered with rich earth to the depth of about four inches, then another 238 Preparation of mushroom beds.

September. Fruit Garden.

ther stratum of dung about ten inches thick, which should be covered like the former; a third stratum of dung may be laid and covered with earth like the two former. The whole should be made to grow narrower as it advances in height, and formed into a ridge resembling the roof of a house. When the bed is finished it should be covered with straw, to exclude the rain, and to prevent the bed from being dried by the sun or wind, in which situation it should remain eight or ten days, when the bed will be in a proper temperature of warmth to receive the spawn. The spawn should be placed in lumps four or five inches asunder, in the sloping sides of the bed, and covered with a little rich earth; the whole must then be covered with a thick coat of straw. When these beds are made in spring or autumn, as the weather in those months is temperate, the spawn will take soon, and the mushrooms will appear in about a month after the bed has been made; but when these are made in winter, when the weather is cold, or even in summer when the weather is very hot, a much longer time will elapse. The principal thing to be attended to, in the management of these beds, is to preserve them in a proper degree of moisture and warmth. Therefore, when the weather is very cold or very wet, care must be taken to apply a thick covering of dry straw, and when the bed appears dry, a gentle watering must be given.

Sect. II. *Fruit Garden.*

239 *Fruit to be exposed to the sun.*

Where any fruit, particularly grapes, are shaded with leaves, pains should be taken to expose them to the rays of the sun, that they may acquire proper flavour, likewise when the clusters are entangled, they should be disengaged, that each may have the benefit of the sun and air.

240 *Plant strawberries.*

Strawberries may be planted any time this month when the weather is showery. If rain should not fall towards the beginning of the month, the transplanting should be deferred, otherwise they must be watered occasionally, for some time after they are planted. If any were planted into beds in June, they will be in excellent condition for planting out now; but if none were planted out then, the best rooted plants produced at the joints of the runners, or offsets from the old plants, should be chosen, and planted at the distance of a foot or 15 inches from one another, either in beds, about four feet wide, or in rows along the borders. Most kinds of strawberries succeed best in an open situation, but the wood strawberry may be planted under the shade of trees or bushes.

241 *Different kinds of strawberries.*

The principal kinds of strawberries, are, the scarlet or Virginian, white wood, green wood, red wood, large white wood, hautboy strawberry, large globe hautboy, oblong hautboy, royal hautboy, green hautboy, Chili strawberry, globe Chili, sugar-loaf Chili, pine apple Chili, Bath Chili, Carolina Chili, white Carolina Chili, Devonshire Chili, Royal Chili, Dutch Chili, Alpine or prolific, which produces fruit from June to November, red Alpine, white Alpine, scarlet Alpine, pine-apple strawberry, red, white, and green.

About the end of the month, most of the late pears and apples will be fit for taking down, to be laid up for keeping. See October.

Sect. III. *Flower Garden, or Pleasure Ground.*

Transplant and propagate fibrous-rooted perennial plants by slips.

Towards the end of the month, hyacinths, tulips, and other bulbs, may be planted. See October.

Sect. IV. *Nursery.*

Transplant evergreens towards the end of the month, such as Portugal laurels, laurustinus, arbutus, &c.

Both evergreens and deciduous trees and shrubs may be propagated by layers or cuttings about the end of the month.

Sect. V. *Green-house and Hot-house.*

About the end of the month, if the weather be cold, orange and lemon trees, and many of the tenderer kinds of green-house plants, should be removed into the house.

About the end of this month or beginning of next, the tan-bed in the hot-house should be refreshed with a quantity of new tan, one half or two-thirds according as the old tan may be more or less decayed.

OCTOBER.

Sect. I. *Kitchen Garden.*

Plant out some of the lettuces that were raised in August, into a well-sheltered border, or into a hot-bed frame, to supply the table during winter and spring. Cauliflowers that were planted out last month from the seed-bed, may now be planted under hot bed frames, at the distance of about four inches from one another, or under bell or hand glasses. Four or five plants may be put under each hand glass, all of which (should they survive the winter) may again be planted out in the spring, except one, or at most two, of the strongest, which should be allowed to remain and produce heads. See February.

Propagate aromatic vegetables by slips, such as thyme, mint, balm, sage, &c.

Asparagus beds should receive their winter dressing, i. e. their stalks should be cut down, and the alleys between the beds should be dug, and a little of the earth from the alleys spread over the surface of each bed. Asparagus beds require some dung once every two years, which should be applied at this season. Before the alleys are dug, a little well rotten dung should be spread over the surface of the beds, dug in with a fork, and covered with a little of the earth from the alleys. Where forced asparagus is required early in winter, a hot-bed may be made any time this month. See January.

Plant some early Mazagan beans, and hotspur peas, about the end of the month, to stand the winter, and produce a crop early in summer.

Sect. II. *Fruit Garden.*

Winter pears and apples should in general be gathered this month. Some will be fit to take down the beginning

October. Fruit Garden. beginning of the month, others will not be ready before the middle or towards the end. To know when the fruits have had their full growth, some of them should be tried in different parts of the tree, by turning them gently upwards; if they quit the tree easily, it is a sign of maturity, and time to gather them. But none of the more delicate eating pears should be permitted to hang longer on the trees than the middle of the month, especially if the nights prove frosty; for if they are once touched with the frost, it will occasion many of them to rot before they are fit for the table: and therefore, in general, let neither apples nor pears remain longer on the trees than the middle or the end of this month, for they will not improve by hanging on the trees after that time. The best apples and pears which are intended for long keeping, should be taken down one by one, on a dry day, and carefully put into baskets, to be carried to the fruitery, or place where they are to be stored up. The fruit themselves should be dry when taken down from the trees, therefore should not be gathered too early in the morning, before the dew on their surface has evaporated. They should be laid in a heap for ten days or a fortnight, that their watery juices may transpire; each should then be thoroughly dried with a cloth, and laid on the shelves of the fruitery, or in boxes or hampers well covered with dry straw or hay.

Prune and plant fruit trees. About the end of the month, apricots, peaches, and nectarines may be pruned. See JANUARY.

All sorts of fruit trees may be planted, such as apricots, peaches, nectarines, plums, cherries, apples, pears, quinces, vines, figs, mulberries, medlars, services, filberts, &c. The ground for this purpose should be trenched to the depth of one or two spades, and should be well manured. If the borders on which the fruit trees are to be planted have not a sufficient depth of soil, a quantity of good earth may be added. Peaches, nectarines, apricots, plums, and cherries, are commonly planted at the distance of about fifteen feet from one another. Pears and apples when engrafted on dwarf stocks may be planted about the same distance, but those which are on free stocks, about eighteen or twenty feet. Cherries and plums for standards should be planted at the distance of twenty or twenty-five feet from one another. Apples and pears, on free stocks, should be planted in rows, thirty or forty feet asunder, and at the distance of twenty-five or thirty feet from one another in the row. Dwarf apples and pears, however, may be planted at less than half that distance.

The principal kinds of apricots are, the early muscadine, Turkey, Brussels, Roman, Breda, orange, Algiers, royal, Moor-park, alberget, transparent, Dunmore, or apricot peach, and Portugal.

The principal sorts of peaches are, the red magdalen, white magdalen, red nutmeg, white nutmeg, nobless, early Newington, old Newington, great French mignone, small mignone, admirable chancellor, Millet's mignone, incomparable, violet native, purple native, Royal George, Montauban, teton de Venus, round transparent, Catharine, and bloody peach.

The principal kinds of nectarines are, early nutmeg, Newington, red, Roman, violet, musk, golden, scarlet, Elruge, Temple, Murray, Brugnion, white Italian.

The principal sorts of plums are, the Primordan or early white, Precoce or early black, early Morocco, Orleans, green gage, la royale, damas de Tour, damas violette, white bonum magnum or egg plum, red bonum magnum or Imperial, Perdrigron white, Perdrigron violet, Monsieur plum, drap d'or, royal dauphin, Fotheringham, azure native, or early blue gage, queen mother, myrobalan, apricot plum, red, white, diaprée, Monsieur native, Roche carbon, Jaune native, grosse queen Claude, petite queen Claude, imperiale violette or blue imperial, petite mirabille, damas musque, diaprée noire, diaprée violette, imperitrice blanche or white empress, imperitrice noire or late black, Spanish damas, damas of September, St Catharine, common damson, Bullace.

The principal kinds of cherries are, the early May, May-duke, arch-duke, Harrison's duke, white heart, black heart, bleeding heart, Adams's crown heart, Hertfordshire heart, ox heart, Turkey, carnation, amber, Kentish or Flemish, Portugal, morella, white crossian, black coroun, small black guigne or geen, small red guigne, smallest wild black of the woods and hedges, ditto red.

251 Apples. The principal kinds of apples are, the common codlin, Kentish codlin, Dutch codlin, Margaret, golden pippin, gold rennet, Holland pippin, Kentish pippin, nonpareil, royal russet, Wheeler's russet, golden russet, gray russet, winter pearmain, scarlet pearmain, Loan's pearmain, aromatic russet, pomme d'Appis, Newton pippin, English rennet, autumn rennet, winter queening, margille, nonesuch, gray Leadington, Marget, tender rennet, kitchen rennet, large white, Italian, Spanish rennet, Canada rennet, grosse rennet de Normandie, Fearns pippin, white French rennet, cluster pearmain, lemon pippin, French pippin, winter greening, winter pippin, Flanders pippin, white costin, Kirton pippin, stone pippin, courpendu or hanging body, courpendu red, rambour summer, rambour winter, rennet grise, French rennet, cat's head, leather-coat, russet of winter, pomme de gelée, Siberian crab, American cherry crab, two years apple, hanging on the trees, if permitted, till the second year.

252 Pears. The principal kinds of pears are, the green missal, Catharine, jargonelle, cuisse madame, Windsor chamontelle, cressane, echasserie, grasse blanquette, beuré de roi, white beuré, winter beuré, colmar, St Germain, lent St Germain, Martinsee, grasse muscat, autumn muscat, orange bergamot, Hambden's, bergamot, red beuré, golden beuré, brown beuré, great rousselet, petit rousselet, Holland bergamot, verte longue, winter bonchretien, summer ditto, Spanish ditto, Messieur Jean, Green sugar, la marquis, swan egg, virgleuse, Portugal, gray goodwife, citron de carmes, ambrette, royal d'hiver, St Michael, Louise bonne, summer orange, winter orange, Swiss bergamot, devionett.

Baking pears. Large black pear of Worcester, Parkinson's warden, Uvedale St Germain, cadillac. The principal kinds of quinces are the Portugal, apple quince, pear quince. The principal kinds of mulberries are the common black, white, red, medlars, Dutch, Nottingham or English. Services. Common wild service, bervey, sweet service or serb, apple-shaped, pear-shaped berry-shaped.

253 Figs. The principal sorts of figs are, the common blue, early long blue, early white, large white, large Genoa, Brunswick, Marseilles, Cyprian, brown Ischia, brown Malta.

November. Kitchen Garden.

Malta. Filberts. Large red skinned filbert, white skinned, common hazel nut, Barcelona nut, cob nut, cluster nut, Byzantine nut.

Gooseberries, currants, and raspberries, may likewise be planted about the end of this month. See JANUARY.

SECT. III. *Flower Garden*, or *Pleasure Ground.*

254 Bulbous roots planted.

BULBOUS-rooted plants, such as tulips, hyacinths, narcissus, jonquils, crocus, dens-canis, crown imperial, sword lily, ixia, Persian and English iris, ranunculus, and anemone, may be planted any time this month, either in beds by themselves, or in flower borders, together with other flowers; but the finer sorts of tulip, hyacinths, ranunculus, and anemone, are commonly planted in beds, six or eight inches distant, and two or three deep.

Plant out deciduous and evergreen trees and shrubs. The method of planting all these is to open a circular hole, wide enough to receive the roots, and about a spade deep, more or less, according to the length of the roots.

Thorn and other hedges may be planted towards the end of this month, or any time in the course of the next.

SECT. IV. *Nursery.*

255 Sow stone fruit, &c.

SOW haws, hollyberries, hips, barberries, yew-berries, acorns, beech-masts, maple and ash-seed, cherry and plum stones, in a bed about four feet wide. It is a common practice to keep haws and hips, in heaps covered over with earth for twelve months; for those which are sown without this preparation frequently lie a whole year in the seed-bed without coming above ground. Plant cuttings of laurels and evergreens.

SECT. V. *Green-house and Hot-house.*

THE hardier kinds of green-house plants should be all removed into the green-house, when they should have plenty of air, except in very cold or wet weather.

The succession pine-apple plants should be removed into the fruiting house, which should previously receive a quantity of new tan, as directed last month. The younger succession plants likewise should be moved into the place of those that have been transferred into the fruiting house, air should be given freely in mild weather, and water very moderately.

NOVEMBER.

SECT. I. *Kitchen Garden.*

256 Blanch endive, &c.

TIE up endive for blanching, continue to earth-up cardoons, and dress the plantations of artichokes, i. e. cut down their larger leaves, and lay some earth about the plants, to protect them during winter.

Carrots and parsneps may be taken up, and preserved in sand during the winter.

Some more peas and beans may be sown to succeed those that were sown last month, or to supply their place if they should be cut off by the severity of the weather.

November. Fruit Garden.

SECT. II. *Fruit Garden.*

THE best time for pruning vines is immediately after the fall of the leaf, because the greatest possible time in that way is allowed for healing the wounds. Vines that are cut about the time of the rise of the sap in the spring, are apt to bleed profusely; this happens sometimes even to those that are pruned in the course of the winter. It is a common error, in pruning vines, to allow the branches to grow too close together, particularly in those varieties which grow vigorously, and have very large leaves; for, in summer, when the leaves are fully expanded, they are so much crowded together as to exclude the rays of the sun from the fruit. When pruning is properly performed, the young branches should be left at the distance of from one foot or two feet, and even upwards, from one another; but this in a great measure must be regulated by the size of their leaves. The Syrian grape has leaves about a foot and a half broad, with foot-stalks six inches long. The black Hamburgh has leaves twelve or thirteen inches broad, with foot-stalks seven inches long. The black cluster on the contrary has leaves five inches broad, with foot-stalks three inches long. Blue frontignac and claret grape have leaves six inches broad, with foot-stalks about four inches long. When vines are weakly, each shoot should be shortened so as to leave only three or four eyes; when they are moderately vigorous, each should be left about a foot long. When very vigorous, some of the shoots may be left three or four feet long or more; the shoots of vines, however, that are trained to the rafters of a vinery or pine-stove may be left eighteen or twenty feet long. It has been observed, that both the largest grapes and finest clusters are produced on shoots of a considerable length. When vines have been allowed to run into confusion, much time and pains are requisite to reduce them to regularity; but when they have been trained regularly from the beginning, pruning is easily and expeditiously performed.

If the following directions for training vines in a vinery be observed, they will easily be kept in order, and plentiful crops of good fruit may be expected.

Vines may be planted both on the back wall and front of a vinery; those on the back wall should be planted from six to twelve feet asunder, according to the vigour of growth of the particular sort, and in such a position that the two uppermost buds may point east and west; those on the front should be planted so as one may be trained to each rafter. When the vines begin to grow, all the buds except the two uppermost must be rubbed off from those on the back wall, and all except the uppermost from those on the front wall. If any of the plants shew fruit the first year, the clusters should be rubbed off, as well as the tendrils and lateral shoots, and the principal shoots should be trained regularly to the trellis as they advance in growth. Fires should be put in the vinery during the spring, to encourage an early growth in the vines, that they may have full time to ripen their wood. In the month of June the glasses may be taken off altogether, but should be put on again in September, and continued till the fall of the leaf, when the vines should be pruned. The two shoots which each vine on the back wall was permitted to push, should be cut down to their third or fourth bud, according

November. Fruit Garden.

according as either of them appears fullest and strongest, and then bent down as near as possible to a horizontal position, forming a figure resembling the letter T. Plants in front that are trained to the rafters, should be cut down almost to the bottom, and no more left than is merely sufficient to train them to the rafter. Only two shoots should again be permitted to grow on each plant on the back wall, and one on those of the front, and these may be allowed to run the whole height of the house before they are stopped. After the vine shoots are stopped (which is done by pinching off their tops), they will in general push out laterals at three or four eyes, on the upper part of the shoot. These laterals should not entirely be taken off, as it would cause more eyes lower upon the shoots to push out. It would therefore be prudent to permit the first laterals to grow twelve or fourteen inches, and then to pinch off their tops. These laterals, in their turn, will push out secondary laterals, which should be pinched off at the second or third joint, and in that way the sap may be diverted till the end of the season.

The shoots of the plants on the back wall must be brought down to a horizontal position, and cut so that the branches of each plant may reach within a foot of the other. If all the vines on the rafters have pushed vigorously, it will be proper to prune every other plant down to three or four eyes, and the rest to from twenty to twenty-five eyes each, the latter being intended to produce fruit, and the former to make bearing wood against another year. When the vines begin to push in the spring of the third year, the shoots of those on the back wall should not be allowed to stand nearer one another than a foot or fifteen inches, all the intermediate buds being carefully rubbed off. The shoots ought to be trained up perpendicularly, and however vigorous they may be, no more than one cluster should be allowed to remain on any of them: all of them may run up to the height of five or six feet before they are stopped. The shoots on the rafters, that were pruned to twenty or twenty-five eyes each, will probably push at all of them; but not more than five or seven shoots should be permitted to remain, even on the strongest; viz. a leading shoot, and two or three on each side. Care being taken to leave one shoot as near the bottom as possible, as the whole branch will require to be pruned down to this shoot next winter. Only one shoot should be left upon those vines that were pruned down to three or four eyes, at every other rafter; and this must be trained up the rafter as in the preceding year. At next pruning season all the shoots proceeding from the horizontal branches of the vines in the back wall should be pruned down to three or four eyes. The vines on the front which produced fruit should be pruned to their lowest shoot, which should be shortened, so as to leave four or five eyes. Those at every other rafter which were shortened the preceding year, and which were allowed to push one shoot, should now be pruned like the bearers of the former year; i. e. twenty or twenty-five eyes should be left on each. In the following and all succeeding seasons, these vines on the front will require a similar management, with this difference, that, as they acquire more strength, they may be permitted to push more shoots, and more clusters may be allowed to remain on each shoot; for, as the vines advance in age, they will certainly be enabled to produce every year for a certain period, a larger crop of fruit. The spurs of the vines on the back-wall, i. e. the shoots that were shortened to three or four eyes, should be allowed to push up one shoot: these shoots at next pruning season must be cut so as to leave a long one, viz. about four feet, and a short one, alternately. The long ones should be allowed to push five shoots (all the other buds being rubbed off), the four lateral of which should be cut down to two or three eyes each, at next pruning season, and the terminal one should be left about a foot and a half long. The short shoots between the long ones must constantly be pruned down to two or three eyes each, in order to keep up a proper succession of bottom wood. The pruning following season must be the same, with this difference, that the upright shoots, as they have acquired a foot and a half additional length, may be allowed to push seven shoots instead of five.

259 Different kinds of grapes.

The principal kinds of vines (E) are, * the white muscat of Alexandria, * black damascus, * golden gallician, *†white frontinac, *†grisly frontinac, *†black or purple frontinac, †‡ blue or violet frontinac, †‡ red frontinac, *† white sweet water, *† black Hamburgh, *† red Hamburgh or Gibraltar grape, * white Hamburgh, *† malvoise or blue tokay, *† genuine tokay, *† flame-coloured tokay, †‡ brick grape, *† white muscadine or chasselas, *† royal muscadine or d'arboyce, *† Malmsey grape, *† claret grape, * Syrian, †‡ Burgundy or Munier grape, †‡ small black cluster, † large black cluster, †‡ early black July grape or morillon, noir natif, † white parsley-leaved.

260 Prune gooseberries and currants.

Gooseberries and currants may be pruned any time from the fall of the leaf, till their buds begin to grow in the spring. If these bushes be not well pruned, the fruit will neither be large nor well-flavoured. The principal thing to be attended to is, to keep them open; for they are very apt to become over-crowded with branches: all suckers therefore which arise from the root, or shoots which proceed from the main stem, should be removed, because they would only create confusion, by growing up into the heart of the bush. When last summer's shoots stand too thick, on the main branches, which is frequently the case, particularly with gooseberries, they should be thinned, and few either of them or of the main branches should be shortened, because the more they are shortened the more liable they are to run to wood. They who make use of garden-shears, for sake of expedition, which is too frequently the case, may save time, and make neat-looking bushes, but will be disappointed with respect to the quantity and quality of their fruit.

Sect. III. *Flower Garden*, or *Pleasure Ground*.

November. Flower Garden or Pleasure Ground.

Fibrous-rooted perennial plants may still be planted; likewise bulbous-rooted plants, such as tulips, hyacinths, &c.

Shrubs and ornamental or forest trees may be transplanted

(E) Those marked * are for a hot-house; those marked † are for a vinery; and those marked ‡ are for a common wall.

December. Kitchen Garden.

planted now or any time during the winter when the weather is open.

Sect. IV. *The Nursery.*

Transplant young trees and shrubs, and protect tender seedlings during severe weather.

Sect. V. *Green-House and Hot-House.*

The plants in the green-house should have air during the day, whenever the weather will permit, and should receive but little water. The plants in the hot-house should likewise receive air during the day in favourable weather, and fires must be put on every evening, but seldom need to be continued during the day, except the weather is very severe.

DECEMBER.

Sect. I. *Kitchen Garden.*

The cauliflower plants and lettuces planted under hot-bed frames, or under bell or hand-glasses, should be exposed to the air during the mild days, and protected during severe weather with a covering of mats or straw. In dry weather celery and cardoons should be earthed up, and endive tied up for blanching.

In this month there is nothing to be done either in the fruit garden, nursery, green-house, or hot-house, that has not already been taken notice of in the preceding months.

261 Construction of green-houses.

Here we shall add some observations on the construction of green-houses and hot-houses.

A green-house constructed for the protection of such vegetables as cannot stand in the open air during winter, may vary in form and dimensions according to the fancy of the proprietor, and the number of plants it is intended to contain. When the front only is of glass, which formerly was the only, and even still is the prevalent, mode of constructing green-houses, the pillars between the sashes ought to be as narrow as the weight they have to support will admit of, and formed so as to give the least possible obstruction to the light; they may be either of stone, brick, wood, or cast iron. The height of the sashes should equal if not exceed the width of the house, that a sufficient quantity of light may be thrown on the plants which stand near the back wall, otherwise they will lose colour, become unhealthy and deformed; for not only the colour, but the vigour, and even the form of vegetables, depends on the light. When one half or the whole of the roof is of glass, which ought to be the case, there is no necessity for attending to the proportion the height ought to bear to the width of the house. The ends of the house should also be of glass, unless when it is connected with a series of other buildings. The pots containing the plants are commonly set on benches, which gradually increase in height as they recede from the front; however, when the roof is of glass, the arrangement may be different. Every green-house ought to be furnished with flues; for though many winters may occur in which the application of fire heat may not be necessary, yet such intense frosts at times prevail as would infallibly kill a great many of the plants: external coverings, it is true, are frequently made use of as a protection against the severity of the weather, but they do not answer the purpose equally well, for when the frost continues long they cannot be applied day and night without doing injury, by excluding air and light; the application of fire-heat is likewise necessary for banishing the damp, which very much injures and frequently destroys the plants, during long-continued, dull, rainy weather. The flues in green-houses are frequently confined to the back wall, but they ought to pass in front of the house likewise, because the plants situated there are most liable to be injured by the severity of the weather.

Construction of Green-houses.

As fires are seldom required, and those but very slight ones, merely to banish frost and damp, it will not be necessary from economical motives to construct the flues so as to throw off the greatest possible quantity of heat; they may therefore be concealed, that they may not affect the appearance of the house.

Hot-houses for rearing plants which grow in warmer climates, or for forcing at an early period such vegetables as grow in the open air, vary considerably according to the different purposes for which they are intended. 1st, Conservatories, or dry stoves, so called because they are constructed without pits for containing tanners bark, oak leaves, or other fermentable substances, and in which the plants grow in the earth which forms the floor of the house, and not in pots. These are commonly of a considerable width and height, and are either covered entirely, or at least on the front, roof, and ends, with glass. 2dly, Hot-houses for rearing exotic plants, furnished with a pit containing tanners bark, oak leaves, heated sand, &c. in which pots containing the plants are plunged: these likewise are of considerable breadth and height, and have their front, roof, and ends, covered with glass. 3dly, Pine-houses, which are furnished with a pit, as above: these are low, the roof being within a few feet of the surface of the pit, that the pine plants may be as near the light as possible, and the roof and part of the front only need be of glass.

Vine-houses are commonly constructed without pits, and are generally about 12 or 14 feet high, sometimes very narrow, at other times of considerable breadth; the former answer best for forcing at a very early period, and in both houses the vines are commonly trained both to the back and front.

Peach houses are almost always constructed without pits, are of a moderate height, and vary in breadth. The peaches are trained either to the front or back, or to both; and sometimes they are planted in the middle of the house, and allowed to grow like standard fruit trees, in which case the house should be capacious.

Cherry and fig-houses are constructed nearly in the same way as peach-houses. The flues for warming all these ought to pass round the front as well as the back of the house, and ought to have as much of their surface exposed as possible; for the more of the surface of the flue comes in contact with the air of the house, the more readily the house will be warmed: therefore they ought not to be built in contact with the front or back walls when that can be avoided, but ought to be supported on pillars of brick to keep them from resting on the ground.

The furnaces for containing the fuel are placed sometimes

Construction of Green-houses, &c.

times in front, sometimes at the end, but most frequently behind the house. They ought to be situated so far below the level of the flue, as is necessary to cause a sufficient draught; if this be not attended to, the smoke will not pass through the flues to warm the houses, but escape some other way. When the furnaces are about 18 inches high (a common size), they ought to be placed about two feet below the level of the flue, that the heated air may have an ascent of about six or eight inches, which will be sufficient to give the requisite draught.

When the hot-house is of considerable extent, it is better to employ several moderate, than a smaller number of strong fires, for violent fires are apt to crack the flues, in which case the smoke escapes into the house, and injures the plants. Some are partial to large fires, from an idea that they consume less fuel in proportion; but this is a mistake, for two moderate fires are found to heat the same extent of hot-house to an equal degree, and more equably, with a less expenditure of fuel than one large one. One moderate fire will be sufficient for an extent of 500 or 600 square feet of glass, but if the house is protected with coverings during the night, it will be sufficient for 700 or 800: thus the number of square feet of glass being known, the requisite number of fires may be easily ascertained. The fires employed for warming hot-houses may at the same time be converted to other useful purposes. At Billing in Northamptonshire, the seat of Lord John Cavendish, the furnaces are constructed to burn lime at the same time that they heat the hot-house. One furnace can burn four bushels of lime, and consume about three-fourths of a hundred weight of coal, when lighted only at night and in the morning.

Construction of Green-houses, &c.

Hot-houses are sometimes protected during the winter nights by external coverings of wood or canvas, &c. This renders less fire necessary; but the saving in point of fuel is more than overbalanced by the original expence of the covering, by the trouble of taking it off and putting it on morning and evening, and by the quantity of glass broken, particularly when the covering is made of canvas, which is apt to be dashed against the glass by the wind. When light coverings of cloth are applied internally they are not liable to the last-mentioned objection, but there are few hot-houses where they can be so applied.

INDEX TO PART III.

GARDINER, Stephen, bishop of Winchester, and lord chancellor of England, born at Bury St Edmunds in Suffolk, was natural son to Richard Woodville, brother to Queen Elizabeth wife to Edward IV. was learned in the canon and civil laws, and in divinity. He signed the divorce of Henry VIII. from Katharine of Spain; abjured the pope's supremacy; and wrote *De vera et falsa obedientia*, in behalf of the king; yet in Edward's reign he opposed the reformation, and was punished with imprisonment; but Queen Mary coming to the throne, she enlarged him. He drew up the articles of marriage between the queen and Philip of Spain, which were very advantageous to England. He was violent against the reformers; but on his death-bed was dissatisfied with his life, and often repeated these words: *Erravi cum Petro, sed non flevi cum Petro.* He died in 1555.

GARGARISM (from γαργαριζω, "to wash the mouth;") a gargle. Its use is for washing the mouth and throat with, when inflammations, ulcerations, &c. are there. A small quantity may be taken into the mouth, and moved briskly about, and then spit out; or if the patient cannot do this to any advantage, the liquor may be injected by a syringe. When gargles are required, their use should be more frequently repeated than is done in common practice.

GARGET, a disease of cattle, consisting in a swelling of the throat and the neighbouring parts; to prevent which bleeding in the spring is recommended.

GARGIL, a distemper in geese, which by stopping the head frequently proves mortal. Three or four cloves of garlic, beaten in a mortar with sweet butter, and made into little balls, and given the creature fasting, are the ordinary cure.

GARIDELLA, a genus of plants belonging to the decandria class, and in the natural method ranking under the 26th order, *Multisiliquæ*. See Botany *Index*.

GARIZIM, Gerizim, or *Gerisim*, in *Ancient Geography*, a mountain of Samaria, at the foot of which stood Sichem; so near, that Jotham could be heard by the Sichemites from its top, (Judges, ix. 7.). Famous for the temple built on it by Sanballet, in favour of his son-in-law Manasseh, by the permission of Alexander the Great, and 200 years after destroyed by John Hyrcanus, son of Simon, the fourth in succession of the Asmoneans (Josephus).

GARLAND, a sort of chaplet made of flowers, feathers, and sometimes precious stones, worn on the head in manner of a crown.—The word is formed of the French *guirlande*, and that of the barbarous Latin *garlanda*, or Italian *ghirlanda*. Menage traces its origin from *gyrus* through *gyrulus*, to *gyrulare*, *gyrlandum*, *ghirlandum*; and at length *ghirlanda* and *guirlande*; so that *guirlande* and *garland* are descended in the sixth or seventh degree from *gyrus*.—Hick rejects this derivation, and brings the word from *gardel handa*, which in the northern languages signify a *nosegay artfully wrought with the hand.*

Garland also denotes ornaments of flowers, fruits, and leaves, intermixed; anciently much used at the gates of temples, where feasts and solemn rejoicings were held; or at any other place where marks of public joy or gaiety were required, as at triumphal arches, tournaments, &c.

GARLIC. See Allium, Botany *Index*.

GARMENT, that wherewith any person is clothed. See Dress and Habit.

GARNET, in *Natural History*, a very beautiful gem, of a red colour, with an admixture of blue. See Mineralogy *Index*.

When pure and free from blemishes, it is little inferior in appearance to the oriental ruby, though only of a middle degree of hardness between the sapphire and common crystal. It is found of various sizes, from that of a pin's head to an inch in diameter.

Among lapidaries and jewellers, genuine garnets are known by different names according to their different degrees of colour. 1. The garnet, simply so called, is the finest and most valuable kind, being of a very deep blood-red with a faint admixture of blue. 2. The rock-ruby; a name very improperly given to the garnet when it is of a very strong but not deep red, and has a fairer cast of the blue; this is a very beautiful gem. 3. The sorane or serain garnet; that of a yet brighter red, approaching to the colour of native cinnabar, Garnet Garrick.

cinnabar, with a faint blue tinge. 4. The almandine, a garnet only a little paler than that called the *rock-ruby*.

Garnet-Colour. See *Colouring of Glass*.

To imitate Garnets. The making the counterfeit garnet in paste is done as follows.—Take prepared crystal two ounces, common red-lead six ounces, manganese 16 grains, zaffre three grains; mix all well, put them into a crucible, cover it with lute, and set it in a potter's kiln for 24 hours. Or take crystal two ounces, minium five ounces and a half, manganese 15 grains, zaffre four grains: mix them well together; and let all be baked, in a pot well luted, in a kiln, 24 hours.

GARONNE, a large river of France, which has its source in the Pyrenean mountains, and falls into the sea 60 miles below Bourdeaux.

Garonne, *Upper*, a department in the south of France. The south part extends to the Pyrenees, and is rugged and mountainous: the north part has a hilly or undulating surface. It produces corn, wine, olives, silk, figs, almonds, and abounds in pasturage. The mountains contain mines of copper, lead, iron, and coal. The population in 1815 was 367,000. Thoulouse is the chief town.

GARRICK, David, Esq. the great Roscius of his age and country, who for nearly 40 years shone the brightest luminary in the hemisphere of the stage, was born at the Angel Inn at Hereford, in the year 1716. His father, Captain Peter Garrick, was a French refugee, and had a troop of horse which were then quartered in that city. This rank he maintained in the army for several years, and had a majority at the time of his death; that event, however, prevented him from ever enjoining it. Mr Garrick received the first rudiments of his education at the free-school at Litchfield; which he afterwards completed at Rochester, under the celebrated Mr Colson, since mathematical professor at Cambridge. Dr Johnson and he were fellow-students at the same school; and it is a curious fact, that these two celebrated geniuses came up to London in the same coach, with the intention of pushing themselves into active life. On the 9th of March 1736, he was entered at the honourable society of Lincoln's Inn. The study of the law, however, he soon quitted; and followed for some time the employment of a wine merchant: but that too disgusting him, he gave way at last to the irresistible bias of his mind, and joined a travelling company of comedians at Ipswich in Suffolk, where he went by the name of *Lyddle*. Having in this poor school of Apollo got some acquaintance with the theatric art, he burst at once upon the world, in the year 1740-1, in all the lustre of perfection, at the little theatre in Goodman's Fields, then under the direction of Henry Giffard.

The character he first performed was Richard III. in which, like the sun bursting from behind a cloud, he displayed in the earliest dawn even more than meridian brightness. His excellence dazzled and astonished every one; and the seeing a young man, in no more than his 24th year, and a novice in reality to the stage, reaching at one single step to that height of perfection which maturity of years and long practical experience had not been able to bestow on the most capital performers of the English stage, was a phenomenon that could not but become the object of universal speculation and of as universal admiration. The theatres at the west end of the town were deserted; Goodman's Fields, from being the rendezvous of citizens and citizens wives alone, became the resort of all ranks of men; and Mr Garrick continued to act till the close of the season.

Having very advantageous terms offered him for the performing in Dublin during some part of the summer (1741), he went over thither, where he found the same just homage paid to his merit which he had received from his own countrymen. To the service of the latter, however, he esteemed himself more immediately bound; and therefore in the ensuing winter, engaged himself to Mr Fleetwood, then manager of Drury Lane; in which theatre he continued till the year 1745, when he again went over to Ireland, and continued there the whole season, joint manager with Mr Sheridan in the direction and profits of the theatre royal in Smock Alley. From thence he returned to England, and was engaged for the season of 1746 with Mr Rich at Covent Garden. This was his last performance as a hired actor: for in the close of that season, Mr Fleetwood's patent for the management of Drury Lane being expired, and that gentleman having no inclination further to pursue a design by which, from his want of acquaintance with the proper conduct of it, or some other cause, he had considerably impaired his fortune; Mr Garrick, in conjunction with Mr Lacy, purchased the property of that theatre, together with the renovation of the patent; and in the winter of 1747, opened it with the greatest part of Mr Fleetwood's company, and with the great additional strength of Mr Barry, Mrs Pritchard, and Mrs Cibber, from Covent Garden.

Were we to trace Mr Garrick through the several occurrences of his life,—a life so active, so busy, and so full of occurrences as his, we should swell this account to many pages. Suffice it to say, he continued in the unmolested enjoyment of his fame and unrivalled excellence to the moment of his retirement. His universality of excellence was never once attacked by competition. Tragedy, comedy, and farce, the lover and the hero, the jealous husband who suspects his wife without cause, and the thoughtless lively rake who attacks her without design, were all alike his own. Rage and ridicule, doubt and despair, transport and tenderness, compassion and contempt; love, jealousy, fear, fury, and simplicity; all took in turn possession of his features, while each of them in turn appeared to be the sole possessor of his heart. In the several characters of Lear and Hamlet, Richard, Dorilas, Romeo, and Lusignane; in his Ranger, Bayes, Drugger, Kitely, Brute, and Benedict, you saw the muscular conformations that your ideas attached to them all. In short, Nature, the mistress from whom alone this great performer borrowed all his lessons, being in herself inexhaustible, this her darling son, marked out for her truest representative, found an unlimited scope for change and diversity in his manner of copying from her various productions. There is one part of theatrical conduct which ought unquestionably to be recorded to Mr Garrick's honour, since the cause of virtue and morality, and the formation of public manners, are considerably dependent upon it; and that is, the zeal with which he aimed to banish from the stage all those plays which carry with them an immoral tendency, and

Garrick.

and to prune from those which do not absolutely, on the whole, promote the interests of vice, such scenes of licentiousness and liberty, as a redundancy of wit and too great liveliness of imagination have induced some of our comic writers to indulge themselves in, and to which the sympathetic disposition of our age of gallantry and intrigue has given sanction. The purity of the English stage has certainly been much more fully established during the administration of this theatrical minister, than it had ever been during preceding managements. He seems to have carried his modest, moral, chaste, and pious principles with him into the very management of the theatre itself, and rescued performers from that obloquy which had attached to the profession. Of those who were accounted blackguards, unworthy the association of the world, he made gentlemen, united them with society, and introduced them to all the domestic comforts of life. The theatre was no longer esteemed the receptacle of all vice; and the moral, the serious, the religious part of mankind, did not hesitate to partake of the rational entertainment of a play, and pass a cheerful evening undisgusted with the licentiousness, and uncorrupted by the immorality, of the exhibition.

Notwithstanding the numberless and laborious avocations attendant on his professsion as an actor, and his station as a manager; yet still his active genius was perpetually bursting forth in various little productions in the dramatic and poetical way, whose merit cannot but make us regret his want of time for the pursuance of more extensive and important works. It is certain that his merit as an author is not of the first magnitude: but his great knowledge of men and manners, of stage effect, and his happy turn for lively and striking satire, made him generally successful; and his prologues and epilogues in particular, which are almost innumerable, possess such a degree of happiness, both in the conception and execution, as to stand unequalled. His ode on the death of Mr Pelham ran through four editions in less than six weeks. His Ode on Shakespeare is a masterly piece of poetry; and when delivered by himself, was a most capital exhibition. His alterations of Shakespeare and other authors have been at times successful, and at times exploded. The exclusion of the gravediggers scene from Hamlet will never be forgotten to him by the inhabitants of the gallery at Drury. Though necessary to the chasteness of the scene, they cannot bear to lose so much true sterling wit and humour; and it must be owned, that exuberances of that kind, though they hurt the uniformity, yet increase the luxuriance of the tree. Among his alterations the following are part; Every Man in his Humour, altered from Ben Johnson; Romeo and Juliet, Winter's Tale, Catherine and Petruchio, Cymbeline, Hamlet, &c. altered and made up from Shakespeare; Gamesters, a comedy, from Shirley; Isabella, from Southerne. To these we add, as original productions, The Farmer's Return, and Linco's Travels, interludes; Guardian, Lethe, Lying Valet, Miss in her Teens, Male Coquet, Irish Widow, and other comedies in two acts; Enchanter, a musical entertainment; Lilliput: the Christmas Tale is ascribed to him, and many others.

We now bring him to the period of his retirement in the spring of 1776; when, full of fame, with the acquirement of a splendid fortune, and growing into years, he thought proper to seek the vale of life, to enjoy that dignified and honourable ease which was compatible with his public situation, and which he had so well earned by the activity and the merits of his dramatic reign. But very short indeed was the period allotted to him for this precious enjoyment: for on the 20th of January 1779, he departed this life; leaving no one rival in excellence upon earth to compensate for his loss, or a hope of our ever meeting with his like again.

Garrison. Garstang.

GARRISON, in the art of war, a body of forces, disposed in a fortress, to defend it against the enemy, or to keep the inhabitants in subjection: or even to be subsisted during the winter season: hence *garrison* and *winter quarters* are sometimes used indifferently for the same thing; and sometimes they denote different things. In the latter case, a garrison is a place wherein forces are maintained to secure it, and where they keep regular guard, as a frontier town, a citadel, castle, tower, &c. The garrison should be always stronger than the townsmen.

Du Cange derives the word from the corrupt Latin *garnisio*, which the latter writers use to signify all manner of munition, arms, victuals, &c. necessary for the defence of a place, and sustaining of a siege.

Winter quarters signify a place where a number of forces are laid up in the winter season, without keeping the regular guard.

GARSTANG, a town in Lancashire, 227 miles from London, It is near a mile in length, but built in a very irregular manner, with dirty streets, and very indifferent houses. The population amounts to 790 persons. The church is a stately Gothic structnre. By the late inland navigation, it 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, Westmoreland, Chester, &c. W. Long. 2. 42. N. Lat. 53. 52.

GARTER, a ligatnre for tying up the stocking; but particularly used for the badge of a noble order of knights, hence denominated the

Order of the GARTER, a military order of knighthood, the most noble and ancient of any lay order in the world, instituted by Edward III. The knights companions are generally princes and peers; and the king of England is the sovereign or chief of the order. The number of knights was originally 26: but six were added in 1786, on account of the increase of the royal family. They are a college or corporation, having a great and little seal.

Their officers are a prelate, chancellor, register, king-at-arms, and usher of the black rod. They have also a dean, and 12 canons and petty canons, vergers, and 26 pensioners or poor knights. The prelate is the head. This office is vested in the bishop of Winchester, and has ever been so. Next to the prelate is the chancellor; which office is vested in the bishop of Salisbury, who keeps the seals, &c. The next is the register, who by his oath is to enter upon the registry, the scrutinies, elections, penalties, and other acts of the order, with all fidelity: The dean of Windsor is always register *ex officio*. The fourth officer is Garter and king-at-arms, being two distinct offices united in one person.

Garter

Garter carries the rod and sceptre at the feast of St George, the protector of this order, when the sovereign is present. He notifies the election of new knights, attends the solemnity of their installation, carries the garter to foreign princes, &c. He is the principal officer within the college of arms, and chief of the heralds. See *King-at-Arms*.

All these officers except the prelate have fees and pensions. The college of the order is seated in the castle of Windsor, within the chapel of St George, and the charter house, erected by the founder for that purpose. The habit and ensign of the order, are, a garter, mantle, cape, george, and collar. The three first were assigned the knights companions by the founder; and the george and collar by Henry VIII.

The garter challenges pre-eminence over all the other parts of the dress, by reason that from it the noble order is denominated; that it is the first part of the habit presented to foreign princes and absent knights, who, and all other knights-elect, are therewith first adorned; and it is of so great honour and grandeur, that by the bare investiture with this noble ensign, the knights are esteemed companions of the greatest military order in the world. It is worn on the left leg between the knee and calf, and is enamelled with this motto, HONI SOIT QUI MAL Y PENSE; i. e. *Shame to him that thinks evil hereof:* The meaning of which is, that King Edward having laid claim to the kingdom of France, retorted shame and defiance upon him that should dare to think amiss of the just enterprise he had undertaken, for recovering his lawful right to that crown; and that the bravery of those knights whom he had elected into this order, was such as would enable him to maintain the quarrel against those that thought ill of it.

The mantle is the chief of these vestments made use of upon all solemn occasions. The colour of the mantle is by the statutes appointed to be blue. The length of the train of the mantle only distinguishes the sovereign from the knights companions. To the collar of the mantle is fixed a pair of long strings, anciently woven with blue silk only, but now twisted round, and made of Venice gold and silk, of the colour of the robes, with knobs or buttons, and tassels at the end. The left shoulder of the mantle has from the institution been adorned with a large garter, with the device HONI SOIT, &c. Within this is the cross of the order, which was ordained to be worn at all times by King Charles I. At length the star was introduced, being a sort of cross irradiated with beams of silver.

The collar is appointed to be composed of pieces of gold in fashion of garters, the ground enamelled blue, and the motto gold.

When the knights wear not their robes, they are to have a silver star on the left side; and they commonly bear the picture of St George, enamelled on gold, and beset with diamonds, at the end of a blue ribbon, crossing the body from the left shoulder. They are not to appear abroad without the garter, on penalty of 6s. 8d. paid to the register.

The manner of electing a knight companion into this most noble order, and the ceremonies of investiture, are as follow. When the sovereign designs to elect a companion of the Garter, the chancellor belonging to this order draws up the letters, which, passing both under the sovereign's sign manual and signet of the order, are sent to the person by Garter principal king at arms; and are in this manner, or to the same effect: "We, with the companions of our most noble order of the Garter, assembled in chapter, holden this present day at our castle at Windsor, considering the virtuous fidelity you have shown, and the honourable exploits you have done in our service, by vindicating and maintaining our right, &c. have elected or chosen you one of the companions of our order. Therefore, we require you to make your speedy repair unto us, to receive the ensigns thereof, and be ready for your installation upon the — day of this present month, &c."

The garter, which is of blue velvet bordered with fine gold wire, having commonly the letters of the motto of the same, is, at the time of election, buckled upon the left leg, by two of the senior companions, who receive it from the sovereign, to whom it was presented upon a velvet cushion, by Garter king at arms, with the usual reverence, whilst the chancellor reads the following admonition, enjoined by the statutes: "To the honour of God omnipotent, and in memorial of the blessed martyr St George, tie about thy leg, for thy renown, this noble garter; wear it as the symbol of the most illustrious order, never to be forgotten or laid aside; that thereby thou mayest be admonished to be courageous; and having undertaken a just war, in which thou shalt be engaged, thou mayest stand firm, valiantly fight, and successfully conquer." The princely garter being then buckled on, and the word of its signification pronounced, the knight elect is brought before the sovereign, who puts about his neck, kneeling, a dark blue ribbon, whereunto is appendant, wrought in gold within the garter, the image of St George on horseback, with his sword drawn, encountering with the dragon. In the mean time, the chancellor reads the following admonition: "Wear this ribbon about thy neck, adorned with the image of the blessed martyr and soldier of Christ, St George, by whose imitation provoked, thou mayest so overpass both prosperous and adverse adventures, that having stoutly vanquished thy enemies both of body and soul, thou mayest not only receive the praise of this transient combat, but be crowned with the palm of eternal victory." Then the knight elected kisses the sovereign's hand; thanks his majesty for the great honour done him; rises up and salutes all the companions severally, who return their congratulations. See a representation of the above insignia, among others, on the plate belonging to *Orders of* KNIGHTHOOD.

Since the institution of this order, there have been eight emperors and twenty-eight kings, besides numerous sovereign princes, enrolled as companions thereof. Its origin is somewhat differently related. The common account is, that the countess of Salisbury at a ball happening to drop her garter, the king took it up and presented it to her with these words, '*Honi soit qui mal y pense;* i. e. Evil to him that evil thinks. This accident, it is said, gave rise to the order and the motto; it being the spirit of the times to mix love and war together: but as in the original statutes of this order there is not the least conjecture to countenance such a feminine institution, credit cannot be given to this tradition. Camden, Fern, &c. take it

to

Garter, Garth.

to have been instituted on occasion of the victory obtained by Edward over the French at the battle of Cressy; that prince, say some historians, ordered his garter to be displayed, as a signal of battle: in commemoration whereof, he made a garter the principal ornament of the order, erected in memory of this signal victory, and a symbol of the indissoluble union of the knights.

It appears from Rastel's Chronicle, lib. vi. quoted by Granger in the supplement to his Biographical History, that this order was devised by Richard I. at the siege of the city of Acre, when he caused twenty-six knights, who firmly stood by him, to wear thongs of blue leather about their legs, and that it was perfected in the nineteenth year of Edward III.

In 1551, Edward VI. made some alterations in the ritual of this order: that prince composed it in Latin, the original whereof is still extant in his own hand writing. He there ordained, that the order should no longer be called the order of St George, but that of the Garter; and, instead of the george, hung at the collar, he substituted a cavalier, bearing a book on the point of his sword, with the word *protectio* graven on the sword, and *verbum Dei* on the book: with a buckle in the left hand, and the word *fides* thereon. Larrey.

Garter, *principal King at Arms.* This office was instituted by Henry V.

Garter, and principal king at arms, are two distinct offices united in one person: Garter's employment is to attend the service of the order of the Garter; for which he is allowed a mantle and badge, a house in Windsor castle, and pensions both from the sovereign and knights, and lastly, fees. He also carries the rod and sceptre at every feast of St George, when the sovereign is present, and notifies the election of such as are new chosen; attends the solemnity of their installations, takes care of placing their arms over their seats; and carries the garter to foreign kings and princes, for which services it has been usual to join him in commission with some peer, or other person of distinction.

Garter's oath relates only to services being performed within the order, and is taken in chapter before the sovereign knights. His oath, as king at arms, is taken before the earl marshal.

Garter is also a term in heraldry, signifying the moiety or half of a bend.

GARTH is used in some parts of England for a little backside or close. It is an ancient British word. Gardd, in that language, signifies *garden*, and is pronounced and written *garth*. This word is also used for a dam or wear, &c.

Garth *Men*, is used in our statutes for those who catch fish by means of fish garths, or wears. By statute it is ordained, that no fisher, nor garth men, shall use any nets or engines to destroy the fry of fish, &c. 17 Ric. II. cap. 9. The word is supposed by some to be derived from the Scotch word *gart*, which signifies *forced* or *compelled*; because fish are forced by the wear to pass in a loop, where they are taken.

Garth, *Sir Samuel*, an excellent English poet and physician, was descended from a good family in Yorkshire. He was admitted into the college of physicians at London in 1663. He at that time zealously promoted and encouraged the erecting of the dispensary for the relief of the sick poor, by giving them advice gratis, and medicines at low rates. This work of charity having exposed him and many other physicians to the envy and resentment of several persons of the same faculty as well as apothecaries, he ridiculed them, with a peculiar spirit and vivacity, in a poem called the *Dispensary*, in six cantos, highly esteemed. He was one of the most eminent members of the famous society called the *Kit Kat Club*, which consisted of noblemen and gentlemen distinguished by their excellent parts and affection to the house of Hanover. Upon the accession of George I. he was knighted, and made physician in ordinary to his majesty, and physician general to the army. Nor were these more than just rewards even of his physical merit. He had gone through the office of censor of the college in 1702; and had practised always with great reputation, and a strict regard to the honour and interest of the faculty, never stooping to prostitute the dignity of his profession, through mean and sordid views of self-interest, to any, even the most popular and wealthy characters. In a steady adherence to this noble principle, he concurred with the much celebrated Dr Radcliffe, with whom he was also often joined in physical consultations. He had a very extensive practice, but was very moderate in his views of advancing his own fortune; his humanity and good nature inclining him more to make use of the great interest he had with persons in power, for the support and encouragement of other men of letters. He chose to live with the great in that degree of independency and freedom which became a man possessed of a superior genius, whereof he was daily giving fresh proofs to the public. One of his last performances in polite letters, was his translation of the whole fourteenth book, and the story of Cinnus in the fifteenth book, of Ovid's Metamorphoses. These, together with an English version of the rest, were published in 1717; and he has prefixed an excellent preface to the whole, wherein he not only gives an idea of the work, and points out its principal beauties, but shows the uses of the poem, and how it may be read to most profit. The distemper which seized him the ensuing year, and ended not but with his life, caused a general concern; which was particularly testified by Lord Lansdowne, a brother poet. He died, after a short illness, which he bore with great patience, in January 1719.

Garve, Garumna.

GARVE, Christian, an eminent German philosopher. See Supplement.

GARUMNA, or *Garonne*, a noble and navigable river of Gaul, which, rising from the Pyrenees, formerly bounded Aquitain on the north (Cæsar); but by the new regulation of Augustus divided it in the middle, emptying itself to the north of Burdegala, in the Aquitanic ocean. Mela observes concerning it, that unless it is swelled by winter rains, or the melting of the snow, it is for a great part of the year shoaly and scarcely navigable; but when increased by the meeting tide, whereby its waters are impelled, it is somewhat fuller; and the farther the river advances, it is broader, till at length it resembles a large frith or arm of the sea, not only bearing large vessels, but also so swelling like a raging sea, tosses them extremely, especially if the direction of the wind be one way and that of the current another.

GAS, in *Chemistry*, a general name for all permanently elastic fluids, which are obtained by chemical processes, as *azotic gas*, *muriatic acid gas*, *nitrous gas*. See CHEMISTRY *Index*. It is derived from the German *gascht* or *gast*, signifying the ebullition attending the expulsion of elastic fluids from substances in a state of effervescence. It was first employed by Van Helmont.

GAS LIGHTS. See SUPPLEMENT.

GASCOIGNE, SIR WILLIAM, chief justice of the court of king's bench under Henry IV. A most learned and upright judge: who being insulted on the bench by the prince of Wales, afterwards Henry V. with equal intrepidity and coolness committed the prince to prison; and by this seasonable fortitude laid the foundation of the future glory of that great monarch, who from this event dated his reformation from the licentiousness of his youth. It is not well authenticated that the prince struck Sir William, as recorded by Shakespeare; but all authors agree, that he interrupted the course of justice to screen a lewd servant. Sir William died in 1413.

GASCOIGNE, *George*, an English poet of some fame in the early part of the reign of Queen Elizabeth, was born at Walthamstow in Essex, of an ancient family, and educated at both universities, but principally at Cambridge. From thence he removed to Gray's Inn, and commenced student of the law; but having a genius too volatile for that study, he travelled abroad, and for some time served in the army in the Low Countries. He afterwards went to France; where he became enamoured of a Scottish lady, and married her. Being at length, says Wood, *weary of those vanities*, he returned to England: and settled once more in Gray's Inn, where he wrote most of his dramatic and other poems. The latter part of his life he spent in his native village of Walthamstow, where he died in the year 1578. He had the character of a polite gentleman, an eloquent and witty companion, *et vir inter poetas sui seculi præstantissimus*. His plays, first printed separately, were afterwards, with several other poems, &c. reprinted into two volumes 4to; the first volume in 1577, the second in 1587.

GASCOIN, or GASCOIGN, denotes the hinder thigh of a horse, which begins at the stifle, and reaches to the ply or bending of the ham.

GASCONADE, a boast or vaunt of something very improbable. The term has its rise from the Gascons, or people of Gascony in France, who it seems have been distinguished for bragging and rhodomontade.

GASCONY, the most south-west province of France, is bounded by Guienne on the north, by Languedoc on the east, by the Pyrenees which separate it from Spain on the south, and by the bay of Biscay on the west. It had its name from the ancient inhabitants, called *Gascones* or *Vascones*; by the moderns *Basques*, or *Vasques*. After these were subdued by the Franks, they had for some time dukes of their own, who were subject to the dukes of Aquitaine; but both were at last dispossessed by the kings of France. The country produces corn, wine, fruits, &c. The inhabitants are noted for a corrupt pronunciation: and their tendency to exaggerate their own exploits, has rendered *Gasconade* a proverbial expression.

GASSENDI, PETER, one of the most celebrated philosophers France has produced, was born at Chantersier, about three miles from Digne in Provence, in 1592. When a child, he took particular delight in gazing at the moon and stars as often as they appeared in clear unclouded weather. This pleasure frequently drew him into bye places, in order to feast his eye freely and undisturbed; by which means his parents had him often to seek, not without many anxious fears and apprehensions. They therefore put him to school at Digne; where, in a short time, he made such an extraordinary progress in learning, that some persons, who had seen specimens of his genius, resolved to have him removed to Aix, in order to study philosophy under Fesay, a learned minor friar. This proposal was so disagreeable to his father, who intended to breed him up in his own way to country business, as being more profitable than that of a scholar, that he would consent to it only upon condition that he should return home in two years at farthest. Accordingly young Gassendi, at the end of the appointed time, repaired to Chantersier; but he had not been long there when he was invited to be professor of rhetoric at Digne, before he was quite 16 years of age; and he had been engaged in that office but three years, when his master Fesay dying, he was made professor in his room at Aix. When he had been there a few years, he composed his Paradoxical Exercitations; which, coming to the hands of Nicholas Peiresc, that great patron of learning joined with Joseph Walter prior of Valette in promoting him; and he having entered into holy orders, was first made canon of the church of Digne and doctor of divinity, and then obtained the wardenship or rectorship of that church. Gassendi's fondness for astronomy grew up with his years; and his reputation daily increasing, he was in 1645 appointed royal professor of mathematics at Paris. This institution being chiefly designed for astronomy, our author read lectures on that science to a crowded audience. However, he did not hold this place long; for a dangerous cough and inflammation of the lungs obliged him, in 1647, to return to Digne for the benefit of his native air.—Gassendi wrote against the metaphysical meditations of Descartes; and divided with that great man the philosophers of his time, almost all of whom were Cartesians or Gassendians. He joined to his knowledge of philosophy and the mathematics an acquaintance with the languages and a profound erudition. He wrote, 1. Three volumes on Epicurus's Philosophy; and six others, which contain his own philosophy. 2. Astronomical Works. 3. The Lives of Nicholas de Peiresc, Epicurus, Copernicus, Tycho Brahe, Puerbachius, and Regiomontanus. 4. Epistles, and other treatises. All his works were collected together, and printed at Lyons in 1658, in six volumes folio. He died at Paris in 1658, aged 63.

GASTEROSTEUS, the STICKLEBACK, a genus of fishes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

GAST-HOUND. See *GAZE Hound*.

GASTRIC, in general, something belonging to the stomach.

GASTRIC Juice, a thin pellucid liquor, which distils from

from certain glands in the stomach, for the dilution, &c. of the food. See ANATOMY.

GASTROCNEMIUS, in *Anatomy*. See ANATOMY, *Table of the Muscles*.

GASTROMANCY, or GASTROMANTIA, a kind of divination practised among the ancients by means of words coming or seeming to come out of the belly.

The word is Greek, γαςρομανλια, composed of γαςηρ, *belly*, and μανλια, *divination*.

There is another kind of divination, called by the same name *gastromancy*, which is performed by means of glasses or other round transparent vessels, within which certain figures appear by magic art. It is thus called, because the figures appear as in the belly of the vessels.

GASTRORAPHY, in *Surgery*, the operation of sewing up wounds of the abdomen. See SURGERY.

GASTROTOMY (of γαςηρ, and τεμνω, *I cut*), the operation of cutting open the belly; otherwise called the *Cæsarean section*. See MIDWIFERY.

GATAKER, THOMAS, a learned critic and divine, was born at London in 1574, and studied at St John's college, Cambridge. He was afterwards chosen preacher at Lincoln's Inn; which he quitted in 1611, for the rectory of Rotherhithe in Surry. In 1620, he made a tour through the Low Countries; and in 1624, published at London a book, entitled, Transubstantiation declared by the confession of the Popish Writers to have no necessary foundation in God's Word: he wrote likewise a defence of this discourse. In 1642, he was appointed one of the assembly of divines, and was engaged with them in writing annotations upon the Bible. He died in July 1654, in the 80th year of his age. Besides the above works, he published, 1. A Dissertation upon the Style of the New Testament. 2. *De Nomine Tetragrammata*. 3. *De Diphthongis, sive Bivocalibus*. 4. An Edition and Translation of the Emperor Marcus Antoninus's Meditations. 5. A Collection of Sermons, in folio; and many other works. His piety and charity were very exemplary; and his modesty so great, that he declined all ecclesiastical dignity and court preferments. His extensive learning was admired by Salmasius and other great men abroad; his house was a private seminary for young gentlemen of this nation, and many foreigners resorted to him to receive advice in their studies.

GATE, in *Architecture*, a large door, leading or giving entrance into a city, town, castle, palace, or other considerable building. See ARCHITECTURE.

Thebes, in Egypt, was anciently known by the appellation *with a hundred gates*. In ancient Rome there was a triumphal gate, *porta triumphalis*. In modern Rome there is the *jubilee gate*, which is only opened in the year of a grand jubilee.

The gates of London were many of them converted into gaols or prisons, as Ludgate, Newgate, &c. but they are now removed. The lesser or by-gates are called *posterns*. Gates, through which coaches, &c. are to pass, should not be less than 7 feet broad, nor more than 12; the height to be $1\frac{1}{2}$ the breadth.

GATE, or GAIT, in the manege, called in French *train*, is used for the going or pace of a horse.

GATE, in a military sense, is made of strong planks, with iron bars, to oppose an enemy. They are generally made in the middle of the curtain, from whence they are seen, and defended by the two flanks of the bastions. They should be covered with a good ravelin, that they may not be seen or enfiladed by the enemy. These gates, belonging to a fortified place, are passages through the rampart, which may be shut and opened by means of doors and a portcullis. They are either private or public.

Private gates are those passages by which the troops can go out of the town unseen by the enemy, when they pass to and from the relief of the duty in the outworks, or from any other occasion which is to be concealed from the besiegers.

Public gates are those passages through the middle of such curtains, to which the great roads of public ways lead. The dimensions of these are usually about 13 or 14 feet high, and 9 or 10 feet wide, continued through the rampart, with proper recesses for foot passengers to stand in out of the way of wheel carriages.

GATES of Hell. This expression is used in Scripture, to denote figuratively either the *grave* or the *powers of darkness*, i. e. the devil and his angels.

The Mahometans use the expression literally, and suppose that hell has seven gates. The first is that where Mussulmans, who incur the guilt of sin, will be tormented. The second is for the Christians. The third is for the Jews. The fourth is for the Sabians. The fifth for the Magians or worshippers of fire. The sixth for Pagans and idolaters. And the seventh for hypocrites, who make an outward show of religion, but have none.

GATESHEAD, in the county of Durham, is as it were the suburbs of Newcastle, though it lies in another county, being divided by the river Tyne; over which there is a fine stone bridge, with an iron gate in the middle, having the arms of Durham on one side, and those of Newcastle on the other, which is the boundary between the bishopric and Northumberland. The church is a fine building, with a very high tower, which is seen at a great distance; and in the church-yard are several ancient monuments. Few traces of its ancient monastery remain, except a stone gateway. The population in 1811 amounted to 8782.

GATH, or GETH, in *Ancient Geography*, a celebrated city of the Philistines, and one of their five principalities. It is famous for having given birth to Goliath. David made a conquest of it in the beginning of his reign over all Israel; and it continued subject to the kings his successors till the declension and decay of the kingdom of Judah. Rehoboam rebuilt or fortified it; King Uzziah retook it, and Hezekiah once more reduced it under his subjection.

Gath stood about five or six miles from Jamnia, about 14 south of Joppa, and 32 west of Jerusalem. Hence some authors (among whom is F. Calmet) have committed an egregious mistake in making Gath the most southern, and Ekron the most northern, of the Philistine cities; as if these two had been the two boundaries of their dominions, whereas these two cities are not above five miles asunder; and Gaza is the last of the five satrapies south. And Josephus (in the place already quoted) expresses himself plainly enough, when he says, that Hezekiah took all the Philistine cities

cities from Gaza to Gath; there being many more cities of that name, which signifies in the Hebrew a *wine press*. Several other cities of the name of Geth or Gath are mentioned in Eusebius and St Jerome, whose situation, according to those authors, plainly shows them to have been different places from this, and from each other; besides those which had an adjunct to distinguish them.

This city recovered its liberty and lustre in the time of the prophets Amos and Micah; but was afterwards demolished by Hazael king of Syria, after which it became of but little consideration till the time of the holy war, when Fulk king of Jerusalem built a castle on its ruins.

Gath *Opher*, Gath *Epher*, or *Gath*, in the canton of Opher, in Galilee, was the birth-place of the prophet Jonah. Joshua makes this city to be part of the tribe of Zebulun; and St Jerome, in his preface upon Jonah, says, that it was two miles from Sephoris, otherwise called *Diocæsarea*.

Gath *Rimmon*, a city belonging to the tribe of Dan. St Jerome places it ten miles from Diospolis on the way from Eleutheropolis. It was given to the Levites of Kohath's family.

Gath *Rimmon*, was also a city in the half tribe of Manasseh, on this side Jordan, and was also given for a place of abode to the Levites of Kohath's family.

Gath *Rimmon*, was likewise a city in the tribe of Ephraim, given to the Kohathites.

GATTON, a village in the county of Surry, 19 miles south from London. It lies under the side of a hill going to Reygate; and is supposed to have been known to the Romans, by reason of their coins and other antiquities that have been found here. It is a borough by prescription; and has sent members to parliament ever since the 29th of Henry VI. It was formerly a large town; but is now a mean village, with a small church, and without either fair or market. It sends two members to parliament. The population in 1801 amounted to 112.

Gaubius.

GAUBIUS, Jerome-David, M. D. professor of medicine at Leyden, and afterwards fellow of the Royal Society of London, was born at Heidelberg in the year 1705. From the Jesuits he received the rudiments of his education, and was much esteemed by them on account of his abilities; but his father afterwards sent him to the orphan house of Halle, lest he should be obliged to abjure his religion. The nature of the discipline, however, he here found to be much too severe, which induced him to request his father to remove him from it, which was accordingly complied with. His teacher at this hospital attributing the dislike of young Gaubius to the want of genius, urged him to give his son some mechanical employment; but the father thought proper to indulge his ardent desire after knowledge, and accordingly sent him to Amsterdam to study under his uncle John, who was an eminent physician. After prosecuting his medical studies for some time at Hordwyk, he resolved to visit Leyden, where the immortal Boerhaave was an eminent professor, and whose penetrating eye soon discovered that Gaubius was possessed of talents above mediocrity. He honoured him with unlimited access to his house, delighted in imparting instruction to him, and gradually forwarded the cultivation of his mind. He took the degree of doctor at the age of 20, after a disputation on the nature of solids, containing an abstract of the system which he himself followed through life.

He travelled through various parts of Europe, and when he returned to Heidelberg by the way of Strasburgh, he was appointed city-physician at Deventer in the province of Overyssel; but he soon after removed to Amsterdam. Boerhaave never lost sight of his favourite pupil; for when the infirmities of old age and indefatigable labour made him anxious to resign his chair, Gaubius on his recommendation was appointed to succeed him. He published his Instructions for writing Recipes in the year 1738, by which he acquired great and justly merited approbation, as he reduced the art from a mere mechanical to a scientific form. His Principles of Nosology is perhaps his most masterly performance, as it evinced that he was highly worthy of such a preceptor. His next publication, which appeared in 1771, was his "Adversaria varii Argumenti," a work which was particularly interesting to chemists; and his oration on the 200th anniversary of the academy of Leyden attracted considerable notice, as in it he traced out, with his accustomed acumen, the chief epochs of the arts and sciences in Holland.

He was likewise the author of numerous and valuable papers in the Transactions of the Society of Haerlem, and was editor of many excellent performances, among which we may rank Cramer's *Elementa artis docimasticæ; Albinus de presagienda vita et morte*, and Swammerdam's Book of Nature, which he partly translated. His literary merit spread his fame so far beyond the bounds of his native country, that pupils repaired to Leyden from every quarter of Europe. In addition to his widely extended reputation, he was blessed with the enjoyment of good health till he was 70 years of age, and died on the 29th of November 1780, in his seventy-fifth year.

One work of his, entitled "Institutiones Pathologiæ Medicinalis," was deemed so valuable by Professor Ackerman, and of such singular advantage in academical lectures, that he gave the world a fourth edition of it, published at Nuremberg in 1787.

Gauden.

GAUDEN, Dr Joseph, son of John Gauden vicar of Mayfield in Essex, was born there in 1605. At the commencement of the civil war, he was chaplain to Robert earl of Warwick; who taking part with the parliament against the king, was followed by his chaplain. Upon the establishment of the Presbyterian model of church government, he complied with the ruling powers, and was nominated one of the assembly of divines who met at Westminster in 1643, and took the covenant; yet having offered some scruples and objections to it, his name was afterwards struck out of the list. Nor did he espouse the parliament cause any longer than they adhered to their first avowed principles of reforming only, instead of destroying, monarchy and episcopacy. In this spirit he was one of those divines who signed a protestation to the army against the violent proceedings that affected the life of the king: and a few days after his execution published the famous Εικων Βασιλικη, *A Portraiture of his Sacred Majesty in his Solitude and Sufferings;* which ran through 50 editions in the course of a year. Upon the return of Charles II. he was promoted to the see of Exeter; aud in 1662 was removed to Worcester, much to his regret,

regret, having flattered himself with the hopes of a translation to Winchester; and his death happened the same year. He wrote many controversial pieces suited to the circumstances of the times, and to his own views from them. The *Eikon Basilike* above mentioned he published as the king's private meditations: though on this point there has been a long controversy. After the bishop's death, his widow, in a letter to one of her sons, calls it *The Jewel;* and said, her husband had hoped to make a fortune by it; and that she had a letter of a very great man's, which would clear up that he writ it. This assertion, as the earl of Clarendon had predicted, was eagerly espoused by the anti-royalists, in the view of disparaging Charles I. But it has been observed, that Gauden had too luxuriant an imagination, which betrayed him into a rankness of style in the Asiatic way; and from thence, as Bishop Burnet argues with others, it may be certainly concluded, that not he, but the king himself, was the true author of the Εικων Βασιλικη; in which there is a nobleness and justness of thought, with a greatness of style, that made it be looked on as the best written book in the English language.

GAVEL or Gabel, among builders. See Gabel.

Gavel, in *Law*, tribute, toll, custom, or yearly revenue; of which we had in old time several kinds. See Gabel.

Gavel Kind, a tenure or custom belonging to lands in the county of Kent. The word is said by Lambard to be compounded of three Saxon words, *gyfe*, *eal*, *kyn*, "*omnibus cognatione proximis data.*" Verstegan calls it *gavelkind*, quasi "give all kind," that is, to each child his part: and Taylor, in his history of *gavelkind*, derives it from the British *gavel*, that is, a hold or tenure, and *cenned*, "*generatio* aut *familia*;" and so *gavel cenned* might signify *tenura generationis*.—It is universally known what struggles the Kentish men made to preserve their ancient liberties, and with how much success those struggles were attended. And as it is principally here that we meet with the custom of gavelkind (though it was and is to be found in some other parts of the kingdom), we may fairly conclude, that this was a part of these liberties: agreeable to Mr Selden's opinion, that gavelkind, before the Norman conquest, was the general custom of the realm. The distinguished properties of this tenure are various: some of the principal are these: 1. The tenant is of age sufficient to alienate his estate by feoffment, at the age of 15. 2. The estate does not escheat in case of an attainder and execution for felony; their maxim being, "the father to the bough, the son to the plough." 3. In most places he had the power of devising lands by will, before the statute for that purpose was made. 4. The lands descend, not to the eldest, youngest, or any one son only, but to all the sons together; which was indeed anciently the most usual course of descent, all over England, though in particular places particular customs prevailed.

GAVELET, in *Law*, an ancient and special cessavit used in Kent, where the custom of gavelkind continues, by which the tenant, if he withdraws his rent and services due to the lord, forfeits his land and tenements.

The process of the gavelet is thus. The lord is first to seek by the steward of his court, from three weeks to three weeks, to find some distress upon the tenement, till the fourth court; and if at that time he find none, at this fourth court it is awarded, that he take the tenement in his hand in name of a distress, and keep it a year and a day without manuring; within which time, if the tenant pay his arrears, and make reasonable amends for the withholding, he shall have and enjoy his tenement as before: if he come not before the year and day be past, the lord is to go to the next county court with witnesses of what had passed at his own court, and pronounce there his process, to have further witnesses; and then by the award of his own court, he shall enter and manure the tenement as his own: so that if the tenant desired afterwards to have and hold it as before, he must agree with the lord; according to this old saying: "Has he not since any thing given, or any thing paid, then let him pay five pound for his were, e'er he become healder again." Other copies have the first part with some variation; "Let him nine times pay, and nine times repay."

Gavelet, in London, is a writ used in the hustings, given to lords of rents in the city of London. Here the parties, tenant and demandant, appear by *scire facias*, to show cause why the one should not have his tenement again on payment of his rent, of the other recover the lands on default thereof.

GAUGAMELA, in *Ancient Geography*, a village of Aturia, lying between the rivers Lycus and Tigris; famous for Alexander's victory over Darius. It is said to have been allowed to Darius Hystaspes for the maintenance of a camel; and hence the name. It was not far from a more considerable place called *Arbela;* whence the latter gave the name to the victory. See Arbela.

GAUGE-point of a solid measure, the diameter of a circle whose area is equal to the solid content of the same measure.

GAUGER, a king's officer, who is appointed to examine all tons, pipes, hogsheads, and barrels, of wine, beer, ale, oil, honey, &c. and give them a mark of allowance, before they are sold in any place within the extent of his office.

GAUGING. See Geometry.

Gauging-Rod, an instrument used in gauging or measuring the contents of any vessel. That usually employed is the four-foot gauging rod. It is commonly made of box, and consists of four rules, each a foot long and about three-eighths of an inch square, joined together by three brass joints; by which means the rod is rendered four feet long when the four rules are quite opened, and but one foot when they are all folded together. On the first face of this rod, marked 4, are placed two diagonal lines: one for beer and the other for wine: by means of which the content of any common vessel in beer or wine gallons may be readily found, by putting the rod in at the bung hole of the vessel till it meets the intersection of the head of the vessel with the staves opposite to the bung hole. For distinction of this line, there is written thereon, *beer* and *wine gallons*. On the second face, 5, are a line of inches and the gauge-line; which is a line expressing the areas of circles, whose diameters are the correspondent inches in ale gallons. At the beginning is written, *ale area*. On the third face, 6, are three scales of lines; the first, at the end of which is written *hogshead*, is for finding how many gallons there are in a

Gauging-Rod.

a hogshead when it is not full, lying with its axis parallel to the horizon. The second line, at the end of which is written *B. L.* signifying a *butt lying* is for the same use as that for the hogshead. The third line is to find how much liquor is wanting to fill up a butt when it is standing: at the end of it is written *B. S.* signifying a *butt standing*. In the half of the fourth face of the gauging rod, 7, there are the three scales of lines, to find the wants in a firkin, kilderkin, and barrel, lying with their areas parallel to the horizon. They are distinguished by letters *F. K. B.* signifying a *firkin, kilderkin*, and *barrel*.

Use of the diagonal lines on this rod. To find the content of a vessel in beer or wine gallons, put the brased end of the gauging rod into the bung hole of the cask, with the diagonal lines upwards, and thrust this brased end to the meeting of the head and staves; then with chalk make a mark at the middle of the bung hole of the vessel, and also on the diagonal lines of the rod, right against, over one another, when the brased end is thrust home to the head and staves: then turn the gauging rod to the other end of the vessel, and thrust the brased end home to the end, as before. Lastly, See if the mark made on the gauging rod come even with the mark made on the bung hole, when the rod was thrust to the other end; which if it be, the mark made on the diagonal lines will, on the same lines, show the whole content of the cask in beer or wine gallons.

If the mark made on the bung hole be not right against that made on the rod when you put it the other way, then right against the mark made on the bung hole make another on the diagonal line; and the division on the diagonal line between the two chalks will show the vessel's whole contents in beer or wine gallons. Thus, *e. gr.* if the diagonal line of the vessel be 28 inches four-tenths, its contents in beer gallons will be near 51, and in wine gallons 62.

If a vessel be open, as a half barrel, tun, or copper, and the measure from the middle of one side to the head and staves be 38 inches, the diagonal line gives 122 beer gallons; half of which, viz. 61, is the content of the open half tub.

If you have a large vessel, as a tun or copper, and the diagonal line taken by a long rule proves 70 inches; the content of that vessel may be found thus: Every inch at the beginning end of the diagonal line call ten inches. Thus ten inches becomes 100 inches; and every tenth of a gallon call 100 gallons; and every whole gallon call 1000 gallons.

Example. At 44.8 inches on the diagonal beer line is 200 gallons; so that 4 inches 48 parts, now called 44 inches 8-tenths, is just two-tenths of a gallon, now called 200 gallons; so also if the diagonal line be 76 inches and 7-tenths, a close cask of such diagonal will hold 1000 beer gallons: but an open cask but half so much, viz. 500 beer gallons.

Use of the GAUGE LINE. To find the content of any cylindrical vessel in ale gallons; seek the diameter of the vessel in inches, and just against it on the gauge line is the quantity of ale gallons contained in one inch deep: this multiplied by the length of the cylinder will give its content in ale gallons.

For example, suppose the length of the vessel 32.06, and the diameter of its base 25 inches; to find what is the content in ale gallons? Right against 25 inches on the gauge line is one gallon and .745 of a gallon; which multiplied by 32.06, the length, gives 55.9447 gallons for the content of the vessel.

Gauging-Rod, Gaul.

The bung diameter of a hogshead being 25 inches, the head diameter 22 inches, and the length 32.06 inches; to find the quantity of ale gallons contained in it?—Seek 25, the bung diameter, on the line of inches, and right against it on the gauge line you will find 1.745: take one-third of it which is .580, and set it down twice; seek 22 inches in the head diameter, and against it you will find on the gauge line 1.356; one-third of which added to twice .580 gives 1.6096; which multiplied by the length 32.06, the product will be 51.603776, the content in ale gallons. Note, this operation supposes, that the aforesaid hogshead is in the figure of the middle frustum of a spheroid.

The use of the lines on the two other faces of the rod is very easy; you need only put it downright into the bung hole (if the vessel you desire to know the quantity of ale gallons contained therein be lying) to the opposite staves; and then where the surface of the liquor cuts any one of the lines appropriated to that vessel, will be the number of gallons contained in that vessel.

GAUL, the name given by the Romans to the country that now forms the kingdom of France.—The original inhabitants were descended from the Celtes or Gomerians, by whom the greatest part of Europe was peopled; the name of *Galli*, or *Gauls*, being probably given them long after their settlement in that country. See GALLIA.

The ancient history of the Gauls is entirely wrapped up in obscurity and darkness; all we know concerning them for a long time is, that they multiplied so fast, that their country being unable to contain them, they poured forth in vast multitudes into other countries, which they generally subdued, and settled themselves in. It often happened, however, that these colonies were so molested by their neighbours, that they were obliged to send for assistance to their native country. This was always very easily obtained. The Gauls were upon every occasion, ready to send forth great numbers of new adventurers; and as these spread desolation wherever they came, the very name of *Gauls* proved terrible to most of the neighbouring nations.—The earliest excursion of these people, of which we have any distinct account, was into Italy, under a famed leader named *Bellovesus*, about 622 years before Christ. He crossed the Rhone and the Alps, till then unattempted; defeated the Hetrurians; and seized upon that part of their country, since known by the names of *Lombardy* and *Piedmont*.—The second grand expedition was made by the Cœnomani, a people dwelling between the rivers Seine and Loire, under a general named *Elitonis*. They settled in those parts of Italy, now known by the names of *Bresciano*, the *Cremonese*, the *Mantuan*, *Carniola*, and the *Venetian*.—In a third excursion, two other Gaulish nations settled on both sides of the river Po; and in a fourth, the Boii and Lingones settled in the country between Ravenna and Bologna. The time of these three last expeditions is uncertain.

1 Account of the Gaulish incursions into Italy.

The third expedition of the Gauls was more remarkable than any of the former, and happened about 200 years after that of Bellovesus. The Senones settled between

Gaul.

between Paris and Meaux, were invited into Italy by a Hetrurian lord, and settled themselves in Umbria. Brennus their king laid siege to Clusium, a city in alliance with Rome; and this produced a war with the Romans, in which the latter were at first defeated, and their city taken and burnt; but at length the whole army was cut off by Camillus, insomuch, that not a single person escaped.

Some other expeditions the Gauls undertook against the Romans: in which, though they always proved unsuccessful, by reason of their want of military discipline; yet their fierceness and courage made them so formidable to the republic, that, on the first news of their march, extraordinary levies of troops were made, sacrifices and public supplications offered to the gods, and the law which granted an immunity from military service to priests and old men, was, for the time, abolished.

2 Expedition against the Greeks.

Against the Greeks, the expeditions of the Gauls were very little more successful than against the Romans. The first of these we hear of was about 279 years before Christ, in the year after Pyrrhus had invaded Italy. At this time, the Gauls finding themselves greatly overstocked at home, sent out three great colonies to conquer new countries for themselves. One of these armies was commanded by *Brennus*, another by *Cerethrius*, and the third by *Belgius*. The first entered Pannonia or Hungary; the second Thrace; and the third marched into Illyricum and Macedonia. Here Belgius at first met with great success; and enriched himself by plunder to such a degree, that Brennus envying him, resolved to enter the same countries, in order to share the spoil. In a short time, however, Belgius met with such a total defeat, that his army was almost entirely destroyed; upon which Brennus hastened to the same place. His army at first consisted of 150,000 foot and 15,000 horse: but two of his principal officers revolted, and carried off 20,000 men, with whom they marched into Thrace; where, having joined Cerethrius, they seized on Byzantium and the western coast of the Propontis, making the adjacent parts tributary to them.—To retrieve this loss, Brennus sent for fresh supplies from Gaul; and having increased his army to 150,000 foot, and upwards of 60,000 horse, he entered Macedonia, defeated the general who opposed him, and ravaged the whole country. He next marched towards the straits of Thermopylæ, with a design to invade Greece; but was stopped by the forces sent to defend that pass against him. He passed the mountains, however, as Xerxes had formerly done; upon which the guards retired, to avoid being surrounded. Brennus then having ordered Acichorius, the next to him in command, to follow at a distance with part of his army, marched with the bulk of the forces to Delphi, in order to plunder the rich temple there. This enterprise proved exceedingly unfortunate: a great number of his men were destroyed by a dreadful storm of hail, thunder, and lightning; another part of his army was destroyed by an earthquake; and the remainder, somehow or other, imagining themselves attacked by the enemy, fought against each other the whole night, so that in the morning scarcely one half of them remained. The Greek forces then poured in upon them from all parts; and that in such numbers, that though Acichorius came up in due time with his forces, Brennus found himself unable to make head against the Greeks, and was defeated with great slaughter. He himself was desperately wounded; and so disheartened by his misfortune, that, having assembled all his chiefs, he advised them to kill all the wounded and disabled, and to make the best retreat they could: after which he put an end to his own life. On this occasion, it is said that 20,000 of these unhappy people were executed by their own countrymen. Acichorius then set out with the remainder for Gaul; but, by being obliged to march through the country of their enemies, the calamities they met with by the way were so grievous, that not one of them reached their own country. A just judgment, say the Greek and Roman authors, for their sacrilegious intentions against Delphi.

3 Miserable fate of the army.

The Romans having often felt the effects of the Gaulish ferocity and courage, thought proper at last, in order to humble them, to invade their country. Their first successful attempt was about 118 years before Christ, under the command of Quintus Marcius, surnamed *Rex*. He opened a way betwixt the Alps and the Pyrenees, which laid the foundation for conquering the whole country. This was a work of immense labour of itself, and rendered still more difficult by the opposition of the Gauls, especially those called the Stæni, who lived at the foot of the Alps. These people, finding themselves overpowered by the consular army, set fire to their houses, killed their wives and children, and then threw themselves into the flames. After this Marcius built the city of Narbonne, which became the capital of a province. His successor Scaurus also conquered some Gaulish nations; and in order to facilitate the sending troops from Italy into that country, he made several excellent roads between them, which before were almost impassable. These successes gave rise to the invasion of the Cimbri and Teutones; an account of whose unfortunate expedition is given under the articles CIMBRI, ROME, TEUTONES, &c.

Gau[ls in]vaded the R[o]mans

From this time, the Gauls seemed to be formidable to the Romans, and even seem to have been for some time on good terms with them. At last, however, the Helvetii kindled a war with the republic, which brought Cæsar over the Alps, and ended in the total subjection of the country. Orgetorix was the first cause of it; who had engaged a vast number of his countrymen to burn their towns and villages, and to go in search of new conquests. Julius Cæsar, to whose lot the whole country of Gaul had fallen, made such haste to come and suppress them, that he was got to the Rhone in eight days; broke down the bridge of Geneva, and, in a few days more, finished the famed wall between that city and Mount Jura, now St Claude, which extended seventeen miles in length, was sixteen feet high, fortified with towers and castles at proper distances, and a ditch that ran the whole length of it. If his own account of it may be relied upon, he did not set out till the beginning of April; and yet this huge work was finished by the ides or 13th of the month; so that, subtracting the eight days he was a-coming, it must have been all done in about five days; a prodigious work, considering he had but one legion there, or even though the whole country had given him assistance. Whilst this was doing, and the reinforcements he wanted were coming, he amused the Helvetii,

Surpri[sing] succe[ss of] Julius [Cæ]sar.

Helvetii, who had sent to demand a passage through the country of the Allobroges, till he had got his reinforcements; and then flatly refused it to them: whereupon a dreadful battle ensued; in which they lost one hundred and thirty thousand men, in spite of all their valour; besides a number of prisoners, among whom were the wife and daughter of Orgetorix, the leader of this unfortunate expedition. The rest submitted, and begged they might be permitted to go and settle among the Edui, from whom they originally sprung; and at the request of these last, were permitted to go.

The Gauls were constantly in a state of variance with one another; and Cæsar, who knew how to make the most of these intestine broils, soon became the protector of the oppressed, a terror to the oppressor, and the umpire of all their contentions. Among those who applied to him for help, were his allies the Edui; against whom Ariovistus, king of the Germans, had joined with the Arverni, who inhabited the banks of the Loire, had taken the country of the Sequani from them, and obliged them to send hostages to him. Cæsar forthwith sent to demand the restitution of both, and, in an interview which he soon after obtained of that haughty and treacherous prince, was like to have fallen a sacrifice to his perfidy: upon which he bent his whole power against him, forced him out of his strong intrenchments, and gave him a total overthrow. Ariovistus escaped, with difficulty, over the Rhine; but his two wives, and a daughter, with a great number of Germans of distinction, fell into the conqueror's hand. Cæsar, after this signal victory, put his army into winter quarters, whilst he went over the Alps to make the necessary preparations for the next campaign. By this time all the Belgæ in general were so terrified at his success, that they entered into a confederacy against the Romans as their common enemy. Of this, Labienus, who had been left in Gaul, sent Cæsar notice; upon which he immediately left Rome, and made such dispatch, that he arrived upon their confines in about fifteen days. On his arrival, the Rhemi submitted to him; but the rest appointing Galba king of the Suessiones general of all their forces, which amounted to one hundred and fifty thousand men, marched directly against him. Cæsar, who had seized on the bridge of the Axona, now Aisne, led his light horse and infantry over it: and whilst the others were encumbered in crossing that river, made such a terrible slaughter of them, that the river was filled with their dead, insomuch that their bodies served for a bridge to those who escaped. This new victory struck such terror into the rest, that they dispersed themselves; immediately after which, the Suessiones, Bellovaci, Ambiones, and some others, submitted to him. The Nervii, indeed, joined with the Atrebates and Veromandui against them; and having first secured their wives and children, made a vigorous resistance for some time; but were at length defeated, and the greatest part of them slain. The rest, with their wives and old men, surrendered themselves, and were allowed to live in their own cities and towns as formerly. The Aduatici were next subdued; and, for their treachery to the conqueror, were sold for slaves, to the number of 50,000. Young Crassus, the son of the triumvir, subdued likewise seven other nations, and took possession of their cities; which not only completed the conquest of the Belgæ, but brought several nations from beyond the Rhine to submit to the conqueror. The Veneti, or ancient inhabitants of Vannes in Brittany, who had been likewise obliged to send hostages to the conqueror, were, in the mean time, making great preparations by sea and land to recover their liberty. Cæsar, then in Illyricum, was forced to equip a fleet on the Loire; and having given the command of it to Brutus, went and defeated them by land, as Brutus did by sea; and having put their chief men to death, sold the rest for slaves. The Unelli, with Veridorix their chief, together with the Lexovii and Aulerci, were about the same time subdued by Sabinus, and the Aquitani by Crassus, with the loss of 30,000 men. There remained nothing but the countries of the Morini and Menapii to be conquered of all Gaul. Cæsar marched himself against them; but he found them so well intrenched in their inaccessible fortresses, that he contented himself with burning and ravaging their country; and having put his troops into winter quarters, again passed over the Alps, to have a more watchful eye on some of his rivals there. He was, however, soon after obliged to come to defend his Gaulish conquests against some nations of the Germans, who were coming to settle there, to the number of 400,000. These he totally defeated, and then resolved to carry his conquering arms into Germany; but for an account of his exploits there, see the article GERMANY.

6 A general confederacy against him.

7 The Gauls defeated with great slaughter.

8 The Gauls revolt, but are subdued.

Upon his return into Gaul, he found it labouring under a great famine, which had caused a kind of universal revolt. Cotta and Sabinus, who were left in the country of the Eburones, now Liege, were betrayed into an ambush by Ambiorix, one of the Gaulish chiefs, and had most of their men cut off. The Aduatici had fallen upon Q. Cicero, who was left there with one legion, and had reduced him to great straits: at the same time Labienus, with his legion, was attacked by Indutiomarus, at the head of the Rhemi and Senones; but had better luck than the rest, and by one bold sally upon them, put them to flight, and killed their general. Cæsar acquired no small credit by quelling all these revolts; but each victory cost the lives of so many of his troops, that he was forced to have recourse to Pompey for a fresh supply, who readily granted him two of his own legions to secure his Gaulish conquests.

9 A second revolt.

But it was not long before the Gauls, ever restless under a foreign yoke, raised up a new revolt, and obliged him to return thither. His fear lest Pompey should gain the affections of the Roman people, had obliged him to strip the Gauls of their gold and silver, to bribe them over to his interest; and this gave no small handle to those frequent revolts which happened during his absence. He quickly, however, reduced the Nervii, Aduatici, Menapii, and Treviri; the last of whom had raised the revolt, under the command of Ambiorix: but he found the flame spread much farther, even to the greatest part of the Gauls, who had chosen Vercingetorix their generalissimo. Cæsar was forced to leave Insubria, whither he had retired to watch the motions of Pompey, and, in the midst of winter and snow, to repass the Alps into the province of Narbonne. Here he gathered his scattered troops with all possible speed; and, in spite of the hard weather, besieged and took Noviodunum, now Noyons; and defeated Vercingetorix, who was come to the relief of that place. He next

Gaul. next took the city of Avaricum, now Bourges, one of the strongest in Gaul, and which had a garrison of 40,000 men; of whom he made such a dreadful slaughter, that hardly 800 escaped. Whilst he was besieging Gergovia, the capital of the Arverni, he was informed that the Nitiobriges, or Agenois, were in arms; and that the Ædui were sending to Vercingetorix 10,000 men, which they were to have sent to reinforce Cæsar. Upon this news, he left Fabius to carry on the siege, and marched against the Ædui. These, upon his approach, submitted, in appearance, and were pardoned; but soon after that whole nation rose up in arms, and murdered all the Italian troops in their capital. Cæsar, at this, was in great straits what measures to take; but resolved at length to raise the siege of Gergovia, and at once attack the enemy's camp, which he did with some success; but when he thought to have gone to Noviodunum, or Noyons, where his baggage, military chest, &c. were left, he heard that the Ædui had carried it off, and burnt the place. Labienus, justly thinking that Cæsar would want his assistance in the condition he now was, went to join him, and in his way defeated a Gaulish general named *Camulogenus*, who came to oppose his march; but this did not hinder the revolt from spreading itself all over Celtic Gaul, whither Vercingetorix had sent for fresh supplies, and, in the mean time, attacked Cæsar; but was defeated, and forced to retire to Alesia, a strong place, now Alise in Burgundy, as is supposed. Hither Cæsar hastened, and besieged him; and having drawn a double circumvallation, with a design to starve him in it, as he was likely to have done, upon that account refused all offers of a surrender from him. At length, the long expected reinforcement came, consisting of 160,000 men, under four generals: these made several fruitless attacts on Cæsar's trenches, but were defeated in three several battles, which at length obliged Vercingetorix to surrender at discretion. Cæsar used all his prisoners with great severity, except the Ædui and Arverni, by whose means he hoped to gain their nations, which were the most potent of Celtic Gaul: nor was he disappointed; for both of them submitted to him, and the former received him into the capital, where he spent the winter, after he put his army into winter quarters. This campaign, as it proved one of the hardest he ever had, so he gained more glory by it than any Roman general had done before: yet could not at all by this procure from the servile senate, now wholly dedicated to his rival, a prolongation of his proconsulship; upon which he is reported to have laid his hand upon his sword, and said, that that should do it.

10 They are again subdued.

He was as good as his word; and the Gauls, upon their former ill success, resolving to have as many separate armies as provinces, in order to embarrass him the more, Cæsar, and his generals Labienus and Fabius, were forced to fight them one after another; which they did, however, with such success, that, notwithstanding the hardness of the season, they subdued the Bituriges, Carnutes, Rhemi, and Bellovaci, with their general Correus, by which he at once quieted all the Belgic provinces bordering on Celtic Gaul. The next who followed were the Treviri, the Eburones, and the Andes, under their general Dumnacus. The last place which held out against him was Uxellodunum; which was defended by the two last acting generals of the Gauls, Drapes the Senonian, and Luterius the Cadurcean. The place being strong and well garrisoned, Cæsar was obliged to march thither from the farthest part of Belgic Gaul; and soon after reduced it, for want of water. Here again he caused the right hands of all that were fit to bear arms to be cut off, to deter the rest from revolting afresh. Thus was the conquest of Gaul finished from the Alps and Pyrenees to the Rhine, all which vast tract was now reduced to a Roman province under the government of a prætor. During his several expeditions into Gaul, Cæsar is said to have taken 800 cities; to have subdued 300 different nations; and to have defeated, in several battles, three millions of men, of whom one million were killed, and another taken prisoners.—The history of the country, from the time of its conquest by the Romans to the present, is given under the articles ROME and FRANCE.

11 Gaul reduced to a Roman province.

The Gauls were anciently divided into a great number of different nations, which were continually at war with one another, and at variance among themselves. Cæsar tells us, that not only all their cities, cantons, and districts, but even almost all families, were divided and torn by factions; and this undoubtedly facilitated the conquest of the whole. The general character of all these people was an excessive ferocity and love of liberty. This last they carried to such an extreme, that either on the appearance of servitude, or incapacity of action through old age, wounds, or chronic diseases, they put an end to their own lives, or prevailed upon their friends to kill them. In cities, when they found themselves so straitly besieged that they could hold out no longer, instead of thinking how to obtain honourable terms of capitulation, their chief care very often was to put their wives and children to death, and then to kill one another, to avoid being led into slavery. Their excessive love of liberty and contempt of death, according to Strabo, very much facilitated their conquest by Cæsar; for pouring their numerous forces upon such an experienced enemy as Cæsar, their want of conduct very soon proved the ruin of the whole.

Character, &c. of the ancient Gauls.

The chief diversion of the Gauls was hunting; and indeed, considering the vast forests with which their country abounded, and the multitude of wild beasts which lodged in them, they were under an absolute necessity to hunt and destroy them, to prevent the country from being rendered totally uninhabitable. Besides this, however, they had also their hippodromes, horse and chariot races, tilts and tournaments; at all of which the bards assisted with their poems, songs, and musical instruments.—For an account of their religion, see the article DRUID.

The Gauls were excessively fond of feasting, in which they were very profuse; as, like all other northern nations, they were great lovers of good eating and drinking. Their chief liquors were beer and wine. Their tables were very low They ate but little bread, which was baked flat and hard, and easily broken in pieces; but devoured a great deal of flesh, boiled, roasted, or broiled; and this they did in a very slovenly manner, holding the piece in their hands, and tearing it with their teeth. What they could not part by this way, they cut with a little knife which hung at their girdle. When the company was numerous, the *Coryphee*,

phee, or chief of the feast, who was either one of the richest, or noblest, or bravest, sat in the middle, with the master of the house by his side; the rest took their places next according to their rank, having their servants holding their shields behind them. These feasts seldom ended without bloodshed; but if by chance the feast proved a peaceable one, it was generally accompanied not only with music and songs, but likewise with dances, in which the dancers were armed cap-a-pee, and beat time with their swords upon their shields. On certain festivals they were wont to dress themselves in the skins of beasts, and in that accompany the processions in honour of their deities or heroes. Others dressed themselves in masquerade habits, some of them very indecent, and played several antic and immodest tricks. This last custom continued long after their conversion to Christianity.

GAULANITIS, or Gaulonitis (Josephus); in *Ancient Geography*, according to the different manner of writing the capital, *Gaulan* or *Gaulon*; the extreme part of Bashan to the south, and bordering on the tribe of Gad. It was divided into the Superior, which to the east extended to Arabia; and into the Inferior, which lay on the lake of Genesareth, (Josephus).

GAULON, or Golan, the capital of the Gaulanitis Superior; a Levitical city and place of refuge, (Moses, Joshua).

GAULOS, in *Ancient Geography*, a small island of Sicily, in the African sea, adjoining to Melite or Malta; with commodious harbours; a colony of Phœnicians, with a cognominal town. Gaulonitæ, the people, (Inscription). Now called *Gozo*, five miles to the west of Malta.

GAULTHERIA, a genus of plants belonging to the decandria class; and in the natural method ranking under the 18th order, *Bicornes*. See Botany *Index*.

GAUNT-Bellied, in the manege, is said of a horse whose belly shrinks up towards his flanks.

GAUNTLET. See Gantlet.

GAUNTLOPE, pronounced *Gauntlet*, a military punishment for felony, or some other heinous offence.

In vessels of war, it is executed in the following manner. The whole ship's crew is disposed in two rows, standing face to face on both sides of the deck, so as to form a line whereby to go *forward* on one side, and return *aft* on the other; each person being furnished with a small twisted cord, called a *knittle*, having two or three knots upon it. The delinquent is then stripped naked above the waist, and ordered to pass forward between the two rows of men, and aft on the other side, a certain number of times, rarely exceeding three; during which every person gives him a stripe as he runs along. In his passage through this painful ordeal, he is sometimes tripped up, and very severely handled while incapable of proceeding. This punishment, which is called *running the gauntlet*, is seldom inflicted, except for such crimes as naturally excite a general antipathy among the seamen: as, on some occasions, the culprit would pass without receiving a single blow, particularly in cases of mutiny and sedition. But this mode of punishment is now, we believe, rarely or never resorted to, either in the army or navy.

In the land service, when a soldier is sentenced to run the gauntlope, the regiment is drawn out in two ranks facing each other; each soldier, having a switch in his hand, lashes the criminal as he runs along naked from the waist upwards. While he runs, the drums beat at each end of the ranks. Sometimes he runs three, five, or seven times, according to the nature of the offence. The major is on horseback, and takes care that each soldier does his duty.

GAVIES, or Gaurs. See Gabres.

GAVOTTA, or Gavotte, is a kind of dance, the air of which has two brisk and lively strains in common time, each of which strains is twice played over. The first has usually four or eight bars; and the second contains eight, twelve, or more. The first begins with a minim, or two crotchets, or notes of equal value, and the hand rising; and ends with the fall of the hand upon the dominant or mediant of the mode, but never upon the final, unless it be a rondeau: and the last begins with the rise of the hand, and ends with the fall upon the final of the mode.

Tempi di Gavotta, is when only the time or movement of a gavotte is imitated, without any regard to the measures or number of bars or strains.—Little airs are often found in sonatas, which have this phrase to regulate their motions.

GAURA, a genus of plants belonging to the octandria class; and in the natural method ranking under the 17th order, *Calycanthemæ*. See Botany *Index*.

GAUSE, or Gawse, in *Commerce*, a very thin, slight, transparent kind of stuff, woven sometimes of silk, and sometimes only of thread.—To warp the silk for making of gause, they use a peculiar kind of mill, upon which the silk is wound: this mill is a wooden machine, about six feet high, having an axis perpendicularly placed in the middle thereof, with six large wings, on which the silk is wound from off the bobbins by the axis turning round. When all the silk is on the mill, they use another instrument to wind it off again on two beams: this done, the silk is passed through as many little beads as there are threads of silk; and thus rolled on another beam to supply the loom.

The gause loom is much like that of the common weavers, though it has several appendages peculiar to itself. See Loom.

There are figured gauses; some with flowers of gold and silver, on a silk ground: these last are chiefly brought from China.

GAY, John, a celebrated English poet, descended from an ancient family in Devonshire, was born at Exeter, and received his education at the free school of Barnstaple in that county, under the care of Mr William Rayner.—He was bred a mercer in the Strand; but having a small fortune, independent of business, and considering the attendance on a shop as a degradation of those talents which he found himself possessed of, he quitted that occupation, and applied himself to other views, and to the indulgence of his inclination for the Muses. In 1712 we find him secretary, or rather domestic steward, to the duchess of Monmouth, in which station he continued till the beginning of the year 1714; at which time he accompanied the earl of Clarendon to Hanover, whither that nobleman was despatched by Queen Anne. In the latter end of the same year, in consequence of the queen's death, he returned to England, where he lived in the highest estimation and intimacy of friendship with many

Gay.

many persons of the first distinction both in rank and abilities.—He was even particularly taken notice of by Queen Caroline, then princess of Wales, to whom he had the honour of reading in manuscript his tragedy of the *Captives*; and in 1726 dedicated his *Fables*, by permission, to the duke of Cumberland.—From this countenance shown to him, and numberless promises made him of preferment, it was reasonable to suppose, that he would have been genteelly provided for in some office suitable to his inclination and abilities. Instead of which, in 1727, he was offered the place of gentleman usher to one of the young princesses; an office which, as he looked on it as rather an indignity to a man whose talents might have been so much better employed, he thought proper to refuse; and some pretty warm remonstrances were made on the occasion by his sincere friends and zealous patrons the duke and duchess of Queensberry, which terminated in those two noble personages withdrawing from court in disgust. Mr Gay's dependencies on the promises of the great, and the disappointments he met with, he has figuratively described in his fable of the *Hare with many friends*. However, the very extraordinary success he met with from public encouragement made an ample amends, both with respect to satisfaction and emolument, for those private disappointments.—For, in the season of 1727-8, appeared his *Beggar's Opera*; the vast success of which was not only unprecedented, but almost incredible.—It had an uninterrupted run in London of 63 nights in the first season, and was renewed in the ensuing one with equal approbation. It spread into all the great towns of England; was played in many places to the 30th and 40th time, and at Bath and Bristol 50; made its progress into Wales, Scotland, and Ireland, in which last place it was acted for 24 successive nights; and last of all it was performed at Minorca. Nor was the fame of it confined to the reading and representation alone, for the card table and drawing room shared with the theatre and closet in this respect; the ladies carried about the favourite songs of it engraven upon their fan mounts; and screens, and other pieces of furniture were decorated with the same. In short, the satire of this piece was so striking, so apparent, and so perfectly adapted to the taste of all degrees of people, that it overthrew the Italian opera, that Dagon of the nobility and gentry, which had so long seduced them to idolatry, and which Dennis, by the labours and outcries of a whole life, and many other writers by the force of reason and reflection, had in vain endeavoured to drive from the throne of public taste. The profits of this piece were so very great, both to the author and Mr Rich the manager, that it gave rise to a quibble, which became frequent in the mouths of many, viz. *That it had made* Rich gay, *and* Gay rich; and it has been asserted, that the author's own emoluments from it were not less than 2000l. In consequence of this success, Mr Gay was induced to write a second part to it, which he entitled *Polly*. But the disgust subsisting between him and the court, together with the misrepresentations made of him as having been the author of some diaffected libels and seditious pamphlets, occasioned a prohibition and suppression of it to be sent from the lord chamberlain, at the very time when every thing was in readiness for the rehearsal of it. A very considerable sum, however, accrued to him from the publication of it afterwards in quarto.—Mr Gay wrote several other pieces in the dramatic way, and many very valuable ones in verse. Among the latter, his *Trivia*, or the *Art of Walking the Streets of London*, though his first poetical attempt, is far from being the least considerable, and is what recommended him to the esteem and friendship of Mr Pope: but as, among his dramatic works, his *Beggar's Opera* did at first, and perhaps ever will, stand as an unrivalled masterpiece, so, among his poetical works, his *Fables* hold the same rank of estimation; the latter having been almost as universally read as the former was represented, and both equally admired. Mr Gay's disposition was sweet and affable, his temper generous, and his conversation agreeable and entertaining. But he had one foible, too frequently incident to men of great literary abilities, and which subjected him at times to inconveniences which otherwise he needed not to have experienced, viz. an excess of indolence, without any knowledge of economy. So that, though his emoluments were, at some periods of his life, very considerable, he was at others greatly straitened in his circumstances; nor could he prevail on himself to follow the advice of his friend Dean Swift, whom we find in many of his letters endeavouring to persuade him to the purchasing of an annuity, as a reserve for the exigencies that might attend on old age.—Mr Gay chose rather to throw himself on patronage, than secure to himself an independent competency by the means pointed out to him; so that, after having undergone many vicissitudes of fortune, and being for some time chiefly supported by the liberality of the duke and duchess of Queensberry, he died at their house in Burlington gardens, in December 1732. He was interred in Westminster Abbey, and a monument erected to his memory, at the expence of his aforementioned noble benefactors, with an inscription expressive of their regards and his own deserts, and an epitaph in verse by Mr Pope.

GAZA, Theodore, a famous Greek in the 15th century, was born in 1398. His country being invaded by the Turks, he retired into Italy; where he at first supported himself by transcribing ancient authors, an employment the learned had frequent recourse to before the invention of printing. His uncommon parts and learning soon recommended him to public notice; and particularly to Cardinal Bessarion, who procured him a benefice in Calabria. He was one of those to whom the revival of polite literature in Italy was principally owing. He translated from the Greek into Latin, Aristotle's History of Animals, Theophrastus on Plants, and Hippocrates's Aphorisms; and from the Latin into Greek, Scipio's Dream, and Cicero's Treatise on Old Age. He wrote several other works in Greek and Latin; and died at Rome in 1475.

Gaza, in *Ancient Geography*, a principal city and one of the five satrapies of the Philistines. It was situated about 100 stadia from the Mediterranean, on an artificial mount, and strongly walled round. It was destroyed by Alexander the Great, and afterwards by Antiochus. In the time of the Maccabees it was a strong and flourishing city; but was destroyed a third time by Alexander Jannæus. At present it has a miserable appearance. The buildings are mean, both as to the form and matter. Some remains of its ancient grandeur

grandeur appear in the handsome pillars of Parian marble which support some of the roofs; while others are disposed of here and there, in different parts of almost every beggarly cottage. On the top of the hill, at the north-east corner of the town, are the ruins of large arches sunk low into the earth, and other foundations of a stately building, from whence some of the bashaws have carried off marble pillars of an incredible size. The castle is a contemptible structure, and the port is ruined. E. Long. 34. 55. N. Lat. 31. 28.

GAZE-HOUND, or *Gast-hound*, one that makes more use of his sight than of his nose. Such dogs are much used in the north of England: they are fitter in an open champaign country than in bushy and woody places. If at any time a well-taught gaze-hound takes a wrong way, he will return upon a signal, and begin the chase afresh. He is also excellent at spying out the fattest of a herd; and having separated it from the rest, will never give over the pursuit till he has worried it to death.

GAZEL, in *Zoology*, a species of CAPRA. See MAMMALIA *Index*.

GAZETTE, a newspaper, or printed account of the transactions of all the countries in the known world, in a loose sheet or half sheet. This name is with us confined to that paper of news published by authority. The word is derived from *gazetta*, a Venetian coin, which was the usual price of the first newspaper printed there, and which was afterwards given to the paper itself.

The first gazette in England was published at Oxford, the court being there, in a folio half sheet, November 7. 1665. On the removal of the court to London, the title was changed to the *London Gazette*. The Oxford gazette was published on Tuesdays, the London on Saturdays: and these have continued to be the days of publication ever since.

GAZNA, a city of Asia, once much celebrated, and the capital of a very extensive empire; but which is now either entirely ruined, or become of so little consideration, that it is not taken notice of in our books of geography. The city was anciently an empory and fortress of Sablestan, not far from the confines of India. During the vast and rapid conquests of the Arabs, all this country had been reduced under their subjection. On the decline of the power of the caliphs, however, the vast empire established by Mahomet and his successors was divided into a number of independent principalities, most of which were but of short duration. In the year of the Hegira 384, answering to the 994th of the Christian era, the city of Gazna, with some part of the adjacent country, was governed by Mahmud Gazni; who became a great conqueror, and reduced under his subjection a considerable part of India and most of Persia.

This empire continued in the family of Mahmud Gazni for upwards of 200 years. None of his successors, however, were possessed of his abilities; and therefore the extent of the empire, instead of increasing, was very considerably diminished soon after Mahmud's death. The Seljuks made themselves masters of Khorasan, and could not be driven out; the greatest part of the Persian dominions also fell off; and in the 547th year of the Hegira, the race of Gazni sultans was entirely set aside by one Gauri, who conquered Khosru Shah the reigning prince, and bestowed his dominions on his own nephew Gayathoddin Mohammed. These new sultans proved greater conquerors than the former, and extended their dominions farther than even Mahmud Gazni himself had done. They did not, however, long enjoy the sovereignty of Gazna; for in 1218, Jenghiz Khan having conquered the greatest part of China and almost all Tartary, began to turn his arms westward; and set out against the sultan of Gazna at the head of 700,000 men.

To oppose this formidable army, Mohammed, the reigning sultan, could muster only 400,000 men; and, in the first battle, 160,000 of his troops are said to have perished. After this victory, Jenghiz Khan advanced; Mohammed not daring to risk a second battle, the loss of which would have been attended with the entire ruin of his kingdom. He therefore distributed his army amongst the strongest fortified towns he had in his dominions; all of which Jenghiz Khan took one after another. The rapid progress of his conquests, indeed, almost exceeds belief. In 1219 and 1220, he had reduced Zarnuk, Nur, Bokhara, Otrar, Saganak, Uzkant, Alshash, Jund, Tonkat, Khojend, and Samarcand. Mohammed, in the mean time, fled first to Bokhara; but on the approach of Jenghiz Khan's army, quitted that place, and fled to Samarcand. When this last city was also in danger of being invested, the sultan did not think proper to trust himself in it more than in the other, though it was garrisoned by 110,000 of his bravest troops; and therefore fled through byways into the province of Ghilan in Persia, where he took refuge in a strong fortress called *Estabad*. But being also found out in this retreat, he fled to an island in the Caspian sea called *Abiskun;* where he ended his days, leaving his empire, such as it was, to his son Jaloloddin.

The new sultan was a man of great bravery and experience in war; but nothing was able to stop the progress of the Moguls. In 1220 and 1221, they made themselves masters of all the kingdoms of Kàrazim and Khorasan, committing everywhere such massacres as were never heard of before or since that time. In the mean time Jaloloddin assembled his forces with the utmost diligence, and defeated two detachments of the Mogul army. This happened while Jenghiz Khan was besieging Bamiyan; but answered little other purpose, than serving to bring upon that city the terrible destruction of which an account is given under the article BAMIYAN. Immediately after the reduction of that city, Jenghiz Khan marched towards Gazna; which was very strongly fortified, and where he expected to have found Jaloloddin. But he had left the place 15 days before; and, as Jenghiz Khan's army was much reduced, he might perhaps have stood his ground, had it not been for an accident. He had been lately joined by three Turkish commanders, each of whom had a body of 10,000 men under his command. After his victories over the Moguls, these officers demanded the greatest share of the spoils; which being refused, they separated themselves from the sultan. He used his utmost endeavours to make them hearken to reason; and sent several messages and letters to them, representing the inevitable ruin which must attend their separation, as Jenghiz Khan was

Gazna. was advancing against them with his whole army. At last they were persuaded to lay aside their animosities; but it was now too late; for Jenghiz Khan, being informed of what passed, detached 60,000 horse to prevent their joining the sultan's army; who, finding himself deprived of this powerful aid, retired towards the river Indus. When he was arrived there, he stopped in a place where the stream was most rapid and the place confined, with a view both to prevent his soldiers from placing any hopes of safety in flight, and to hinder the whole Mogul army from attacking him at once. Ever since his departure from Gazna he had been tormented with a colic: yet, at a time when he suffered most, hearing that the enemy's vanguard was arrived at a place in that neighbourhood called *Herder*, he quitted his litter, and, mounting a horse, marched with some of his chosen soldiers in the night; surprised the Moguls in their camp; and having cut them almost all in pieces, without the loss of a single man on his side, returned with a considerable booty.

Jenghiz Khan, finding by this that he had a vigilant enemy to deal with, proceeded with great circumspection. When he came near the Indus, he drew out his army in battalia: to Jagatay, one of his sons, he gave the command of the right wing; to Otkay, another son, he gave the command of the left: and put himself in the centre, with 6000 of his guards. On the other side, Jaloloddin prepared for battle like one who had no resource but in victory. He first sent the boats on the Indus farther off; reserving only one to carry over his mother, wife, and children: but unluckily the boat split when they were going to embark, so that they were forced to remain in the camp. The sultan took to himself the command of the main body of the army. His left wing, drawn up under shelter of a mountain which hindered the whole right wing of the Moguls from engaging at once, was commanded by his vizir; and his right by a lord named *Amin Malek*. This lord began the fight; and forced the enemy's left wing, notwithstanding the great disparity of numbers, to give ground. The right wing of the Moguls likewise wanting room to extend itself, the sultan made use of his left as a body of reserve, detaching from thence some squadrons to the assistance of the troops who stood in need of them. He also took one part of them with him when he went at the head of his main body to charge that of Jenghiz Khan; which he did with so much resolution and vigour, that he not only put it in disorder, but penetrated into the place where Jenghiz Khan had originally taken his station: but that prince having had a horse killed under him, was retired from thence, to give orders for all the troops to engage.

This disadvantage had like to have lost the Moguls the battle; for a report being immediately spread that the enemy had broken through the main body, the troops were so much discouraged, that they would certainly have fled, had not Jenghiz Khan encouraged them by riding from place to place in order to show himself. At last, however, Jaloloddin's men, who were in all but 30,000, having fought a whole day with ten times their number, were seized with fear and fled. One part of them retired to the rocks which were on the shore of the Indus, where the enemy's horse could not follow them; others threw themselves into the river, where many were drowned, though some had the good fortune to cross over in safety; while the rest surrounding their prince, continued the fight through despair. The sultan, however, considering that he had scarce 7000 men left, began to think of providing for his own safety: therefore, having bidden a final adieu to his mother, wife, and children, he mounted a fresh horse, and spurred him into the river, which he crossed in safety, and even stopped in the middle of it to insult Jenghiz Khan, who was now arrived at the bank. His family fell into the hands of the Moguls; who killed all the males, and carried the women into captivity.

Jaloloddin being now securely landed in India, got up into a tree in order to preserve himself from wild beasts. Next day, as he walked melancholy among the rocks, he perceived a troop of his soldiers, with some officers, three of whom proved to be his particular friends. These, at the beginning of the defeat, had found a boat in which they had sailed all night, with much danger from the rocks, shelves, and rapid current of the river. Soon after, he saw 500 horse coming towards him; who informed him of 4000 more that had escaped by swimming over the river; and these also soon after joined the rest. In the mean time an officer of his household, named *Jamalarrazad*, knowing that his master and many of his people were escaped, ventured to load a very large boat with arms, provisions, money, and stuff to clothe the soldiers; with which he crossed the river. For this important service Jaloloddin made him steward of his household, and surnamed him the *Chosen* or the *Glory of the Faith*. For some time after, the sultan's affairs seemed to go on prosperously: he gained some battles in India; but the princes of that country, envying his prosperity, conspired against him, and obliged him to repass the Indus. Here he again attempted to make head against the Moguls; but was at last defeated and killed by them, and a final end put to the once mighty empire of Gazna.

The metropolis was reduced by Otkay; who no sooner entered the country in which it was situated, than he committed the most horrid cruelties. The city was well provided with all things necessary for sustaining a siege; had a strong garrison, and a brave and resolute governor. The inhabitants, expecting no mercy from Jenghiz Khan, who they knew had sworn their ruin, were resolved to make a desperate defence. They made frequent sallies on the besiegers, several times overthrew their works, and broke above 100 of their battering rams. But one night, after an obstinate fight, part of the city walls fell down; and a great number of Moguls having filled up the ditch, entered the city sword in hand. The governor perceiving all was lost, at the head of his bravest soldiers rushed into the thickest of his enemies, where he and his followers were all slain. However, Gazna was not entirely destroyed, nor were the people all killed; for after the massacre had continued for four or five hours, Otkay ordered it to cease, and taxed those who were left alive at a certain rate, in order to redeem themselves and the city. It does not, however, appear that after this time the city of Gazna ever made any considerable figure.—It was taken by the Moguls in the year 1222.

GEBRES.

GEBRES. See GABRES.

GECCO, in *Natural History*, a name given by the Indians to their terrible poison, which kills when mixed with the blood even in the smallest quantity. They say that this gecco is a venomous froth or humour vomited out of the mouths of their most poisonous serpents; which they procure in this fatal strength, by hanging up the creatures by the tails, and whipping them to enrage them: they collect this in proper vessels as it falls; and when they use it, they either poison a weapon with it, or wounding any part of the flesh introduce the smallest quantity imaginable into it; and this is said to be immediate death.

GECKO. See LACERTA, ERPETOLOGY *Index*.

GED, WILLIAM, an ingenious though unsuccessful artist, who was a goldsmith in Edinburgh, deserves to be recorded for his attempt to introduce an improvement in the art of printing. The invention, first practised by Ged in 1725, was simply this. From any types of Greek or Roman, or any other character, he formed a plate for every page, or sheet, of a book, from which he printed, instead of using a type for every letter, as is done in the common way. This was first practised, but on blocks of wood, by the Chinese and Japanese, and pursued in the first essays of Coster the European inventor of the present art. "This improvement (says James Ged the inventor's son) is principally considerable in three most important articles, viz. expence, correctness, beauty and uniformity."

In July 1729, William Ged entered into partnership with William Fenner, a London stationer, who was to have half the profits, in consideration of his advancing all the money requisite. To supply this, Mr John James, then an architect at Greenwich (who built Sir Gregory Page's house, Bloomsbury church, &c.) was taken into the scheme, and afterwards his brother Mr Thomas James, a letter founder, and James Ged the inventor's son. In 1730, these partners applied to the university of Cambridge for printing Bibles and common prayer books by blocks instead of single types; and, in consequence, a lease was sealed to them, April 23. 1731. In their attempt they sunk a large sum of money, and finished only two prayer books; so that it was forced to be relinquished, and the lease was afterwards given up. Ged imputed his disappointment to the villany of the pressmen, and the ill treatment of his partners (which he specifies at large), particularly Fenner, whom John James and he were advised to prosecute, but declined it. He returned to Scotland in 1736, where he gave his friends a specimen of his performance, by an edition of Sallust. But being still unsuccessful, and having failed in obtaining redress from Fenner, who died insolvent, he was preparing again to set out for London, in order to join with his son James as a printer there, when he died October 19. 1749. Ged's son attempted unsuccessfully, in 1751, to revive this invention; Messrs Tilloch and Foulis about the year 1782 practised it on a small scale at Glasgow; and of late years many beautiful editions of the classics have been printed in this way by Didot of Paris, and Wilson and Company of London †.

† See Proc. and Phil. Mag. 267.

GEDDES, ALEXANDER, a learned Scots Catholic divine and eminent bible critic, was born in the parish of Ruthven in Banffshire, in the year 1737. His parents were respectable, although not opulent. His father was a farmer, who deemed no trouble too great, in order to procure for his children as liberal an education as possible. Both father and mother were of the Catholic persuasion, and the only book of consequence which the former had in his library was an English translation of the bible, in which young Geddes was instructed with such care and attention, that he was able to give an account of the history of it before he had reached the eleventh year of his age. The first instructions he received, after those of his parents, were communicated by a school-mistress in the vicinity, by whom he was so much distinguished, that it became the first mental gratification which, in his own opinion, he ever felt. He was next put under the tuition of a young man from the city of Aberdeen, who had been engaged by the *laird* for the education of his own children; and afterwards went to a place called Scalan, in the Highlands, where those were to be trained up who designed to devote themselves to the Catholic priesthood, and to finish their education at some foreign university. Here it was, in this obscure retreat, that Geddes laid the foundation of that intimate acquaintance with the learned languages, by which he was so eminently distinguished in the subsequent part of his life. He went to the Scots university at Paris in the year 1758, and soon after began the study of rhetoric in the college of Navarre. By the strength of his genius and his indefatigable attention, he was soon at the head of this class, although he had to contend with two veterans, and became the favourite of Vicaire the professor, whose friendship lasted to the close of life.

Instead of entering into the philosophical class at the usual time, he studied that subject at home, in order to facilitate his theological studies, on which he entered under M. M. Buré and de Sauvent, at the college of Navarre, and Lavocat at the Sorbonne was his Hebrew preceptor. So great, or rather astonishing, was his progress, that Professor Lavocat urged him strongly to continue at Paris; but his friends prevailed with him to return to his native country in 1764. His first charge as a priest was in a Catholic chapel in the county of Angus, from which he removed to Traquair in 1765, and became chaplain to the earl of that name, where he remained for about three years. This situation was most agreeable to his literary pursuits, as he had unlimited access to a very extensive library, which greatly assisted him in the prosecution of his darling studies. He left the earl's house in the year 1768, and returned to Paris, where he devoted his time during the following winter to the perusal of books and manuscripts in the king's libraries, making large extracts from scarce copies, particularly such as were in the Hebrew tongue.

In the spring of 1769, he returned to his native country, and became pastor of a congregation at Auchinhalrig in Banffshire, where he was for some time involved in pecuniary difficulties, out of which he was extricated by the liberality of the then duke of Norfolk. These were occasioned by the debts he incurred in building a new chapel for his flock, and in making the parson's house one of the neatest and most convenient in Scotland. With the view of bettering his circumstances he commenced farmer; but as he had to borrow money to stock his farm, and as the crops failed for three successive seasons, he was under the necessity of abandoning this scheme in a much poorer state than when he

 first

Geddes.

first projected it. But his unwearied exertions, joined to the assistance of friends, again relieved him, and he was enabled to discharge every claim against him of a pecuniary nature in an honourable manner.

In the year 1779 he resigned his pastoral charge at Auchinhalrig, which was a heavy stroke to the members of his congregation, as the zeal and diligence with which he discharged the duties of his ministerial function had endeared him to all. He was also justly esteemed for his attention to the instruction of youth. Next year the university of Aberdeen conferred on him the degree of LL. D. a literary honour which was never bestowed on any Roman Catholic by that body since the Reformation. He afterwards went to London, that he might prosecute his favourite studies with greater facility, and give the world his English translation of the Old and New Testament, to which he had turned his attention for a number of years. He officiated for some months after his arrival at the imperial ambassador's chapel in Duke-street, till the term of Easter 1782, at which time it was suppressed by order of the emperor Joseph II. after which Dr Geddes seems to have declined entirely the exercise of his clerical functions.

No sooner had the design of Mr Geddes, relative to a new translation of the Bible been made public, than he met with formidable opposition from his Catholic brethren; an event which the doctor with good reason seems to have anticipated. His own words on this occasion were: "I expect not excessive profits from excessive exertion. I trust I shall never want *meat*, and *clothes*, and *fire*; to a philosophical and contented mind, what more is necessary?" He was many years employed in preparing this important work for the press, before he had any prospect of adequate success. In addressing the English Catholics on the subject of his translation, he has these memorable words: "At any rate, I do what I think it my duty to do, and do it fairly and openly. In the following pages ye will find neither palliation nor disguise. I pour out my sentiments with the same sincerity as if I were before the tribunal of Him who is to judge the living and the dead. Mistake I may, but prevaricate I never will." He discovered this noble spirit in every action of his life, and in all his transactions and intercourse with mankind, although he did not conciliate the regard of those who could have bestowed upon him the most effectual assistance.

After spending much of his life in biblical studies, he met with a long and cruel interruption, of which he thus speaks: "I had but little hope of ever living in a situation to resume them, when Providence threw me into the arms of such a patron as Origen himself might have been proud to boast of—a patron, who, for these ten years past, has, with a dignity peculiar to himself, afforded me every convenience that my heart could desire towards the carrying on and completing of my arduous work."

It is needless to inform the public, that the patron to whom the learned doctor here alludes was Lord Petre. For this munificence, continued through the whole of his life, and even beyond it by his latter will, Christians of every denomination will feel sentiments of gratitude, when they are qualified to make a true estimate of the advantages of free and impartial enquiry.

In the year 1792, the first volume of his translation was published, dedicated to his patron Lord Petre, containing the first six books of the Old Testament. Soon after this volume made its appearance, three apostolic vicars, calling themselves the bishops of Rama, Acanthos, and Centuriæ, issued a pastoral letter, addressed to their respective flocks over which they presided, warning them against the reception of Dr Geddes's translation. In his reply to the bishop of Centuriæ we find these words: "Perhaps, my lord, you wish to have another occasion of exercising your episcopal authority, and of playing with censures as children do with a new ball.—I wish your lordship much joy of the bauble; but however, my lord, beware of playing too often with it. Read St Chrysostom on Ecclesiastical Censures, and learn from him a little more moderation. Permit an old priest to tell you, that it is a very great ornament in a *young bishop*. As to myself, my lord, I am not afraid of your threats, and shall laugh at your censures as long as I am conscious that I deserve them not.—You cannot hinder me from praying at home; and at home I will pray, in defiance of your censure, as often as I please. The chief Bishop of our souls is always accessible; and through him I can, at all times, have free access to the Father, who will not reject me, but for voluntary unrepented crimes. In the panoply of conscious innocence, the whole thunder of the Vatican would in vain be levelled at my head."

The second volume of his translation, owing to a variety of interruptions, did not make its appearance till the year 1797, to which was prefixed a dedication to her royal highness the duchess of Gloucester, as an "early, spontaneous, and liberal encourager of the work." In this volume the doctor gives up, and boldly combats, the absolute inspiration of scripture, believing that the Hebrew, like all other historians, wrote from such human documents as they could find, and were of consequence liable to similar mistakes. This latitude of thinking naturally led the doctor to give up as fabulous, and wholly unworthy of the divine philanthropy, every command, precept, and injunction, which appeared unworthy even of human authority. He denied of consequence, that the command given to destroy the Canaanites could have God for its author. This volume of Critical Remarks was published in 1800, in which he enters into an able vindication of his own theory, which rather increased than diminished the number of enemies, for as he wrote to please no party, he foresaw that he would have enemies in every party, and so it happened.

Dr Geddes was a man of extensive literature, uncommon liberality of thinking, the friend of all mankind; a man of integrity, honour, and benevolence; in the strictest sense of the word, a truly genuine Catholic, and whose love of truth was so invincible, that neither hopes nor fears could induce him to conceal it.

His prospectus of a new translation of the Bible in 4to was published in 1786, and a letter to the bishop of London on the same subject in 1787. His proposals were printed in 1788. As a controversial writer, Dr Geddes was eminently distinguished by his letter to Dr Priestley, in defence of the divinity of Jesus Christ, and by one to a member of parliament, on the expediency of a general repeal of the penal statutes

tutes which have a respect to religious opinions. In the spring of the year 1800, he published an apology for the Roman Catholics of Great Britain, in which he zealously defended his peculiar tenets, but displayed a commendable moderation, when he mentioned the injuries to which he himself and brethren were subjected by the continuance of persecuting laws; and, when he argued in behalf of abolishing all legal disabilities, he discovered the soundest logical understanding.

We shall close our short account of this great man in the words of one who was well acquainted with him, and fully qualified to appreciate his merits. "It must be lamented, that, in the death of Dr Geddes, the world has lost the services of a man, who by his acute and penetrating genius—his various, profound, and extensive erudition—his deep research—his indefatigable application—and his independent, dignified, and unfettered spirit, rising superior to the prejudices of education; nobly disdaining the shackles of system; spurning the petty temporizing arts of unmanly accommodation; and setting at defiance all the terrors of malignity, bigotry, and intolerance, was supereminently qualified for the great, laborious, and important work in which he had, for a long series of years, been engaged, of giving an English version of the venerable literary remains of sacred antiquity, the scriptures of the Old and New Testament. During his life, this work did not meet with encouragement adequate to the magnitude of the design; or, it may be added, to the merit of the execution. In this last respect, it will be matter of surprise to all who are competent to judge of the nature of such an enterprise, how much has been done, and with what uncommon ability and success. It everywhere displays the skilful hand of a master."

He had corrected and prepared his translation for the press up to the hundredth and eighteenth psalm, when he was seized with a most painful and excruciating distemper, which put a period to his inestimable life on the 26th of February 1802. The learned world will unquestionably have cause to lament, that Dr Geddes was arrested by the hand of death in the midst of his career, unless that unexpected phenomenon, another Geddes, should make his appearance, and happily finish what his extraordinary predecessor conducted so far with such astonishing abilities; but *rara avis in terris*.

GEHENNA, a scripture term which has given some pain to the critics. It occurs in St Matthew, v. 22. 29. 30. x. 28. xviii. 9. xxiii. 15. 33. Mark ix. 43. 45. 47. Luke xii. 5. James iii. 6.

The authors of the Louvain and Geneva versions retain the word *gehenna* as it stands in the Greek; the like does M. Simon: the English translators render it by *hell* and *hell fire*, and so do the translators of Mons and Father Bohours.

The word is formed from the Hebrew *gehinnom*, i. e. "valley of Hinnom." In that valley, which was near Jerusalem, there was a place named *Tophet*, where some Jews sacrificed their children to Moloch, by making them pass through the fire. King Josias, to render this place for ever abominable, made a cloaca or common sewer thereof, where all the filth and carcases in the city were cast.

The Jews observed farther, that there was a continual fire kept up there, to burn and consume those carcases; for which reason, as they had no proper term in their language to signify *hell*, they made use of that of *gehenna* or *gehinnom*, to denote a fire unextinguishable.

GELA, in *Ancient Geography*, a city of great extent on the south of Sicily, taking its name from the river Gelas, which washes it. It was built by colonists from Rhodes and Crete, 45 years after the building of Syracuse, or in the third year of the 22d Olympiad, 690 before Christ; originally called *Lindii*, from the colonists of *Lindus*, a city of Rhodes, who settled there first. Now *Terra Nuova*, and the river called *Fiume di Terra Nuova*. The people were called *Geloi*, *Gelenses*, and *Gelani*. The city of Gela, after having stood 408 years, was destroyed by Phintias, tyrant of Agrigentum; and the inhabitants were removed to a new city, called *Phintias* after his name.

GELATINA, Jelly. See Jelly.

GELATINOUS, among the physicians, is applied to any thing approaching to the glutinous consistence of a jelly.

GELD, in the English old customs, a Saxon word signifying *money*, or *tribute*. It also denoted a compensation for some crimes committed: Hence *wergeld*, in their ancient laws, was used for the value of a man slain; and *orfgeld*, of a beast.

GELDENHAUR, Gerard, in Latin *Geldenharius*, an historian and Protestant divine in the 16th century. He was a native of Nimeguen, and studied classical learning at Deventer. He went through his course of philosophy at Louvain, where he contracted a very strict friendship with several learned men, and particularly with Erasmus. He became reader and historian to Charles of Austria, and afterwards to Maximilian of Burgundy. At length he embraced the Protestant religion, taught history at Marpurg, and afterwards divinity till his death, in 1542. He wrote, 1. History of Holland. 2. History of Low Countries. 3. History of the bishops of Utrecht; and other works.

GELDERLAND. See Guelderland.

GELDERS. See Guelders.

GELDING, the operation of castrating any animal. See Castration, Farriery *Index*.

GELE'E, Claude. See Claude.

GELENHAUSEN, a small imperial town of Wetteravia in Germany, with a castle built by the emperor Frederic I. E. Long. 8. 13. N. Lat. 50. 20.

GELLENIUS, Sigismund, a learned and excellent man, born of a good family at Prague, about the year 1498. Erasmus conceiving an esteem for him at Basil, recommended him to John Frobenius as a corrector for his printing-house; which laborious charge he accepted, and had a great number of Hebrew, Greek, and Latin books to correct: he also translated many works himself from the Greek and Latin; and published a dictionary in four languages, Greek, Latin, German, and Sclavonian. Profitable and honourable employments were offered him in other places; but nothing could tempt him to quit his peaceful situation at Basil. He died in 1555. All his translations are highly esteemed.

GELINOTTE, or Grus. See Tetrao, Ornithology *Index*.

GELLERT, Christian Furghtegolt, was born at Haynichen, in July 1715, near Freyberg, where his

his father was a clergyman. He was extraordinary professor of philosophy at Leipsic, and a distinguished writer among the Germans. When but 13 years of age he discovered a poetical genius; but having none to guide his taste for this kind of composition, he was led to imitate Gunther, Neukerch, and Hanke, men of indifferent abilities. He studied theology at Leipsic in 1734, and returned home at the expiration of four years, when he commenced public speaker; but his timid disposition prevented him from shining as an orator in the pulpit. The delicacy of his constitution forbidding him to aspire after extensive learning, he confined himself to the acquisition of that which might render him useful. He was much respected for his first attempts in poetry, called Amusements of Reason and Wit, which appeared in 1742.

The labour which he found requisite for the composition of sermons, inclined him to lay aside the clerical profession, and devote himself wholly to the instruction of youth, in which he not only diffused knowledge through the minds of his pupils, but also inspired them with the love of religion and virtue. He was made A. M. in 1744, and published the first volume of his fables in the ensuing year. His "Swedish Countess" was the first German romance deserving of notice. He gave the world the second part of his fables in 1748, although two years before this period he was much afflicted with hypochondriacal affections. In 1751, he was solicited to accept the office of extraordinary professor of philosophy, together with a decent salary, which was augmented on the termination of the war.

Assailed by unconquerable lowness of spirits and confirmed melancholy, he still exhibited the same patience, resignation, and universal philanthropy as he had ever shewn, and which excited the admiration of the enemy during the war. His sufferings continued to increase in severity, and at last terminated his existence on the 13th of December 1769. He contributed much to the improvement of the taste and morals of his countrymen, and their gratitude for his services made them deeply lament his loss. His praise was resounded by every voice, his likeness was cast in gypsum, and moulded in wax; it was engraved on copper, and represented in sculpture and painting.

It is said of this amiable man and captivating writer, by Kutner, who wrote the lives of German authors, that it will probably be a century before the appearance of another poet, so fully qualified to excite the love and admiration of his cotemporaries, and obtain such a powerful influence over the taste and way of thinking of all descriptions of men. If it would indicate too much partiality to call him a genius of the first class, he certainly was a most agreeable and fertile writer; the poet to whom religion and virtue are deeply indebted; an able reformer of public manners, and fonder of affording consolation, than of plunging into despondency. Kutner gives him a most excellent and enviable character, in these words: "As long as the Germans shall understand their present language, will the works of Gellert be read; and his character will be honoured while virtue is known and respected."

GELLI, John Baptist, an eminent Italian writer, was born of mean parents at Florence, in the year 1498. He was bred a taylor, some say a shoemaker; but had such an extraordinary genius, that he acquired several languages, and made an uncommon progress in the belles lettres: and though he continued always to work at his trade, became acquainted with all the wits and learned men at Florence, and his merit was universally known. He was chosen a member of the academy there, and the city made him a burgess. He acquired the highest reputation by his works, which are, 1. *I. Caprici del Bottaio*, quarto; which contains ten dialogues. 2. *La Circe*, octavo. This, which also contains ten dialogues, and treats of human nature, has been translated into Latin, French, and English. 3. Dissertations in Italian on the poems of Dante and Petrarch. 4. The comedies of *La Sporta* and *La Errore*; and other works. He died in 1563.

GELLIBRAND, Henry, a laborious astronomer of the 17th century, was born in 1597. Though he was not without good views in the church, yet he became so enamoured with mathematical studies, that on the death of his father he became a student at Oxford, contented himself with his private patrimony, and devoted himself solely to them. On the death of Mr Gunter, he was recommended by Mr Briggs to the trustees of Gresham college, for the astronomical professorship there; to which he was elected in 1627. His friend Mr Briggs dying in 1630, before he had finished his *Trigonometria Britannica*, it was finished by Gellibrand at his request. He wrote several other things, chiefly tending to the improvement of navigation; and died in 1636.

GELLIUS, Aulus, a celebrated grammarian who lived in the 2d century under Marcus Aurelius and some succeeding emperors. He wrote a collection of observations on authors, for the use of his children; and called it *Noctes Atticæ*, because composed in the evenings of a winter he spent at Athens. The chief value of it is for preserving many facts and monuments of antiquity not to be found elsewhere. Critics and grammarians have bestowed much pains on this writer.

GELLY. See Jelly.

GELO, or Gelon, a son of Dinomenes who made himself absolute at Syracuse 484 years before the Christian era. He conquered the Carthaginians at Himera, and made his oppression popular by his great equity and moderation. He reigned seven years, and his death was universally lamented at Syracuse. He was called the father of his people, and the patron of liberty, and honoured as a demigod. His brother Hiero succeeded him. See Syracuse.

GEM, in *Natural History*, a common name for all precious stones; of which there are two classes, the pellucid and semipellucid.

The bodies composing the class of pellucid gems are bright, elegant, and beautiful fossils, which are found in small detached masses, extremely hard, and of great lustre.

The bodies composing the class of semipellucid gems, are stones naturally compound, not inflammable or soluble in water, found in detached masses, and composed of crystalline matter debased by earth: however, they are but slightly debased; and are of great beauty and brightness, of a moderate degree of transparency, and are usually found in small masses.

The knowledge of gems depends principally on observing their hardness and colour. Their hardness is commonly allowed to stand in the following order: The diamond the hardest of all; then the ruby, sapphire, jacinth, emerald, amethyst, garnet, carneol, chalcedony, onyx, jasper, agate, porphyry, and marble. This difference, however, is not regular and constant, but frequently varies. Good crystals may be allowed to succeed the onyx; but the whole family of metallic glassy fluors seems to be still softer.—In point of colour, the diamond is valued for its transparency, the ruby for its purple, the sapphire for its blue, the emerald for its green, the jacinth for its orange, the amethyst carneol for its carnation, the onyx for its tawney, the jasper, agate, and porphyry, for their vermilion, green, and variegated colours, and the garnet for its transparent blood red.

All these gems are sometimes found coloured and spotted, and sometimes quite limpid and colourless. In this case the diamond cutter or polisher knows how to distinguish their different species by their different degrees of hardness upon the mill. For the cutting or polishing of gems, the fine powder of the fragments of those that are next in degree of hardness is always required to grind away the softer; but as none of them are harder than the diamond, this can only be polished by its own powder.

Cronstedt observes of gems in general, that the colour of the ruby and emerald are said to remain in the fire, while that of the topaz flies off: hence it is usual to burn the topaz, and thence substitute it for the diamond. "Their colours (says our author) are commonly supposed to depend upon metallic vapours; but may they not more justly be supposed to arise from a phlogiston united with a metallic or some other earth? because we find that metallic earths which are perfectly well calcined give no colour to any glass: and that the manganese, on the other hand, gives more colour than can be ascribed to the small quantity of metal which is to be extracted from it." M. Magellan is of opinion, that their colour is owing chiefly to the mixture of iron which enters their composition; but approves the sentiment of Cronstedt, that phlogiston has a share in their production, it being well known that the calces of iron when dephlogisticated produce the red and yellow colours of marble, and when phlogisticated to a certain degree produce the blue or green colours.

With regard to the texture of gems, M. Magellan observes, that all of them are foliated or laminated, and of various degrees of hardness. Whenever the edges of these laminæ are sensible to the eye, they have a fibrous appearance, and reflect various shades of colour, which change successively according to their angular position to the eye. These are called by the French *chatoyantes;* and what is a blemish in their transparency, often enhances their value on account of their scarcity. But when the substance of a gem is composed of a broken texture, consisting of various sets of laminæ differently inclined to each other, it emits at the same time various irradiations of different colours, which succeed one another according to their angle of position. This kind of gems has obtained the name of *opals*, and are valued in proportion to the brilliancy, beauty, and variety of their colours. Their crystallization, no doubt, depends on the same cause which produces that of salts, earths, and metals, which is treated of under the article CRYSTALLIZATION. The following table shows the component parts of gems according to the analysis of Bergman and M. Achard; the letter B prefixed to each denoting Bergman's analysis, and A that of Achard.

Gem.

		Argil.	Silic.	Calc	Iron.
Red oriental ruby, -	B	40	39	9	10
Ditto, - -	A	37.5	42.5	9	11
Blue oriental sapphire, -	B	58	35	5	2
Ditto, - -	A	58	33	6	3
Yellow topaz from Saxony,	B	46	39	8	6
Green oriental emerald, -	B	60	24	8	6
Ditto, - -	A	60	23	10	7
Yellow brown orient. hyacinth,	B	40	25	20	13
Ditto, - -	A	42	22	20	16
Tourmalin from Ceylon, -	B	39	37	15	9
Ditto from Brasil, -	B	50	34	11	5
Ditto from Tyrol, -	B	42	40	12	6
Garnet from Bohemia, -	A	30	48	11	10

But later analyses shew that the component parts are different from the above, particularly the colouring matters which are here ascribed to iron. See MINERALOGY.

The chrysoprase from Koseinitz in Silesia was likewise analyzed by M. Achard; who found that it contained 456 grains of siliceous earth, 13 of calcareous, six of magnesia, three of copper, and two of iron. "This (says M. Magellan) seems to be the only gem that contains no argillaceous earth."

Imitation or Counterfeiting of GEMS *in Glass.* The art of imitating gems in glass is too considerable to be passed without notice: some of the leading compositions therein we shall mention upon the authority of Neri and others.

These gems are made of pastes; and are noway inferior to the native stones, when carefully made and well polished, in brightness or transparence, but want their hardness.

The general rules to be observed in making the pastes are these: 1. That all the vessels in which they are made be firmly luted, and the lute left to dry before they are put into the fire. 2. That such vessels be chosen for the work as will bear the fire well. 3. That the powders be prepared on a porphyry stone; not in a metal mortar, which would communicate a tinge to them. 4. That the just proportion in the quantity of the several ingredients be nicely observed. 5. That the materials be all well mixed; and, if not sufficiently baked the first time, to be committed to the fire again, without breaking the pot; for if this be not observed, they will be full of blisters and air bladders. 6. That a small vacuity be always left at the top of the pot, to give room to the swelling of the ingredients.

To make paste of extreme hardness, and capable of all the colours of the gems, with great lustre and beauty.—Take of prepared crystal, ten pounds; salt of polverine, six pounds; sulphur of lead, two pounds: mix all these well together into a fine powder; make the whole with common water into a hard paste; and make this paste into small cakes of about three ounces weight each, with a hole made in their middle; dry them in the sun, and afterwards calcine them in the straitest part of a potter's furnace. After this, powder

Gem.

der them, and levigate them to a perfect fineness on a porphyry stone, and set this powder in pots in a glass furnace to purify for three days: then cast the whole into water, and afterwards return it into the furnace, where let it stand 15 days, in which time all foulness and blisters will disappear, and the paste will greatly resemble the natural jewels. To give this the colour of the emerald, add to it brass thrice calcined; for a sea green, brass simply calcined to a redness; for a sapphire, add zaffer, with manganese; and for a topaz, manganese and tartar. All the gems are thus imitated in this, by the same way of working as the making of coloured glasses; and this is so hard, that they very much approach the natural gems.

The colour of all the counterfeit gems made of the several pastes, may be made deeper or lighter according to the work for which the stones are designed; and it is a necessary general rule, that small stones for rings. &c. require a deeper colour, and large ones a paler. Besides the colours made from manganese, verdigris, and zaffer, which are the ingredients commonly used, there are other very fine ones which care and skill may prepare. Very fine red may be made from gold, and one not much inferior to that from iron; a very fine green from brass or copper; a sky colour from silver, and a much finer one from the granates of Bohemia.

A very singular and excellent way of making the paste to imitate the coloured gems is this: Take a quantity of saccharum saturni, or sugar of lead, made with vinegar in the common way; set it in sand, in a glass body well luted from the neck downwards; leave the mouth of the glass open, and continue the fire 24 hours; then take out the salt, and if it be not red but yellowish, powder it fine, and return it into the vessel, and keep it in the sand heat 24 hours more, till it becomes as red as cinnabar. The fire must not be made so strong as to melt it, for then all the process is spoiled. Pour distilled vinegar on this calcined salt, and separate the solution from the dregs; let the decanted liquor stand six days in an earthen vessel, to give time for the finer sediment to subside; filter this liquor, and evaporate it in a glass body, and there will remain a most pure salt of lead; dry this well, then dissolve it in fair water; let the solution stand six days in a glazed pan; let it subside, then filter the clear solution, and evaporate it to a yet more pure white and sweet salt; repeat this operation three times; put the now perfectly pure salt into a glass vessel, set it in a sand heat for several days, and it will be calcined to a fine impalpable powder of a lively red. This is called *the sulphur of lead.*

Take all the ingredients as in the common composition of the pastes of the several colours, only instead of red lead, use this powder; and the produce will well reward the trouble of the operation, as experience has often proved.

A paste proper for receiving colours may be readily made by well pounding and mixing six pounds of white sand cleansed, three pounds of red lead, two pounds of purified pearl ashes, and one pound of nitre. A softer paste may be made in the same manner, of six pounds of white sand cleansed; red lead, and purified pearl-ashes, of each three pounds; one pound of nitre, half a pound of borax, and three ounces of arsenic. For common use a pound of common salt may be substituted for the borax. This glass will be very soft, and will not bear much wear if employed for rings, buckles, or such imitations of stones as are exposed to much rubbing; but for ear-rings, ornaments worn on the breast, and those little used, it may last a considerable time.

In order to give paste different colours, the process is as follows: For

Amethyst. Take ten pounds of either of the compositions described under *Colouring of* GLASS, one ounce and a half of manganese, and one drachm of zaffer; powder and fuse them together.

Black. Take ten pounds of either of the compositions just referred to, one ounce of zaffer, six drachms of manganese, and five drachms of iron, highly calcined; and proceed as before.

Blue. Take of the same composition, ten pounds; of zaffer, six drachms; and of manganese, two drachms: and proceed as with the foregoing.

Chrysolite. Take of either of the compositions for paste above described, prepared without saltpetre, ten pounds, and of calcined iron five drachms; and pursue the same process as with the rest.

Red Cornelian. Take of the compositions mentioned under *Colouring of* GLASS, two pounds; of glass of antimony, one pound; of the calcined vitriol called *scarlet ochre*, two ounces; and of manganese, one drachm. Fuse the glass of antimony and manganese with the composition; then powder them, and mix them with the other, by grinding them together, and fuse them with a gentle heat.

White Cornelian. Take of the composition just referred to, two pounds; of yellow ochre well washed, two drachms; and of calcined bones, one ounce. Mix them, and fuse them with a gentle heat.

Diamond. Take of the white sand, six pounds; of red lead, four pounds; of pearl ashes, purified, three pounds; of nitre two pounds; of arsenic five ounces; and of manganese, one scruple. Powder and fuse them.

Aigue-marine. Take ten pounds of the composition under GLASS; three ounces of copper highly calcined with sulphur; and one scruple of zaffer. Proceed as before.

Emerald. Take of the same composition with the last, nine pounds; three ounces of copper precipitated from aquafortis; and two drachms of precipitated iron. See EMERALD, MINERALOGY *Index*.

Garnet. Take two pounds of the composition under GLASS; two pounds of the glass of antimony, and two drachms of manganese. For vinegar garnet, take of the composition for paste, described in this article, two pounds; one pound of glass of antimony, and half an ounce of iron, highly calcined: mix the iron with the uncoloured paste, and fuse them: then add the glass of antimony powdered, and continue them in the heat till the whole is incorporated.

Gold or *full Yellow.* Take of the composition for paste ten pounds; and one ounce and a half of iron strongly calcined; proceeding as with the others.

Deep Purple. Take of either of the compositions for paste, ten pounds; of manganese, one ounce; and of zaffer, half an ounce.

Ruby. Take one pound of either of the compositions

tions for paste, and two drachms precipitate of gold by tin; powder the paste, and grind the calx of gold with it in a glass, flint, or agate mortar, and then fuse them together. A cheaper ruby paste may be made with half a pound of either of the above compositions, half a pound of glass of antimony, and one drachm and a half of the calx of gold; proceeding as before.

Sapphire. Take of the composition for paste, ten pounds; of zaffer, three drachms and one scruple; and of the *calx Cassii*, one drachm. Powder and fuse them. Or the same may be done, by mixing with the paste one-eighth of its weight of smalt.

Topaz. Take of the compositions under GLASS ten pounds, omitting the saltpetre; and an equal quantity of the *Gold-coloured hard* GLASS. Powder and fuse them. See TOPAZ, MINERALOGY *Index*.

Turquoise. Take of the composition for blue paste already described, ten pounds; of calcined bone, horn, or ivory, half a pound. Powder and fuse them.

Opaque white. Take of the composition for paste ten pounds; and one pound of calcined horn, ivory, or bone; and proceed as before.

Semitransparent white, like opal. See OPAL, MINERALOGY *Index*.

To the above we shall add the following receipts and processes, contained in a memoir by M. Fontanieu of the Royal Academy of Sciences at Paris, and said to have met with much approbation.

I. *Of the Bases.* Although the different calces of lead are all adapted to produce the same effect in vitrification; yet M. Fontanieu prefers lead in scales, and next to that minium, as being the most constantly pure. It is necessary to sift through a silk sieve the preparations of lead one wishes to make use of in the vitrification, in order to separate the grosser parts, as also the lead found in a metallic state when white lead in scales is employed.

The base of factitious gems is calx of lead and rock crystal, or any other stone vitrifiable by the calces already mentioned. Pure sand, flint, and the transparent pebbles of rivers, are substances equally fit to make glass: but as it is first necessary to break the masses of crystal, stones, or pebbles, into smaller parts; so by this operation particles of iron or copper are frequently introduced, and to these dust or greasy matters are also apt to adhere. Our author therefore begins by putting the pounded crystal or pebbles into a crucible, which he places in a degree of heat capable of making the mass red hot; he then pours it into a wooden bowl filled with very clear water; and shaking the bowl from time to time, the small portions of coals furnished by the extraneous bodies swim on the surface of the water, and the vitrifiable earth, with the iron, &c. rests on the bottom. He then decants the water; and having dried the mass, he pounds it, and sifts the powder through the finest silk sieve: he then digests the powder during four or five hours with marine acid, shaking the mixture every hour. After having decanted the marine acid from the vitrifiable earth, he washes the latter until the water no longer reddens the tincture of turnsol. The said earth being dried, is passed through a silk sieve, and is then fit for use. Nitre, salt of tartar, and borax, are the three species of salts that enter with quartz and the several calces of lead into M. Fontanieu's vitrifications.

Much of the success in the art of making coloured stones depends on the accurate proportion of the substances made use of to form the crystal which serves as a base to the factitious stones. After having tried a great variety of receipts, our author found they might be reduced to the following.

1. Take two parts and a half of lead in scales, one part and a half of rock crystal or prepared flints, half a part of nitre, as much borax, and a quarter part of glass of arsenic. These being well pulverized and mixed together, are to be put into a Hessian crucible, and submitted to the fire. When the mixture is well melted, pour it into cold water: then melt it again a second and a third time; taking care, after each melting, to throw it into fresh cold water, and to separate from it the lead that may be revived. The same crucible should not be used a second time, because the glass of lead is apt to penetrate it in such a manner as to run the risk of losing the contents. One must also be careful to cover the crucible well, to prevent any coals getting into it, which would reduce the calx of lead, and spoil the composition.

2. Take two parts and a half of white ceruse, one part of prepared flints, half a part of salt of tartar, and a quarter part of calcined borax: melt the mixture in a Hessian crucible, and then pour it into cold water; it is then to be melted again, and washed a second and a third time, the same precautions being observed as for the first base.

3. Take two parts minium, one part rock crystal, half a part of nitre, and as much salt of tartar: this mixture being melted, must be treated as the former.

4. Take three parts of calcined borax, one part of prepared rock crystal, and one part of salt of tartar; these being well mixed and melted together, must be poured into warm water: the water being decanted, and the mass dried, an equal quantity of minium must be added to it; it is then to be melted and washed several times as directed above.

5. That called by our author the *Mayence base*, and which he considers as one of the finest crystalline compositions hitherto known, is thus composed: Take three parts of fixed alkali of tartar, one part of rock crystal or flint pulverized: the mixture to be well baked together, and then left to cool. It is afterwards poured into a crucible of hot water to dissolve the frit; the solution of the frit is then received into a stone-ware pan, and aquafortis added gradually to the solution till it no longer effervesces: this water being decanted, the frit must be washed in warm water till it has no longer any taste: the frit is then dried, and mixed with one part and a half of fine ceruse or white lead in scales; and this mixture must be well levigated with a little distilled water. To one part and a half of this powder dried add an ounce of calcined borax: let the whole be well mixed in a marble mortar, then melted and poured into cold water as the other bases already described. These fusions and lotions having been repeated, and the mixture dried and powdered, a 12th part of nitre must be added to it, and then melted for the last time; when a very fine crystal will be found in the crucible.

6. As a composition for furnishing very fine white stones: Take eight ounces of ceruse, three ounces of

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rock crystal pulverized, two ounces of borax finely powdered, and half a grain of manganese: having melted and washed this mixture in the manner directed above, it will produce a very fine white crystal.

II. *Of the Colours.* The calces of metals, as already observed, are the substances employed to colour factitious gems; and on the preparation of these calces depends the vividness of their colours.

a, From *Gold.*] To obtain the mineral purple known by the name of *precipitate of Cassius*, M. Fontanieu employs the following different processes.

1. Dissolve some pure gold in aqua regia, prepared with three parts of precipitated nitrous acid and one part of marine acid; and to hasten the dissolution, the matrass should be placed in a sand bath. Into this solution pour a solution of tin in aqua regia. The mixture becomes turbid, and the gold is precipitated with a portion of the tin, in the form of a reddish powder; which after being washed and dried, is called *precipitate of Cassius.*—The aqua regia employed to dissolve the tin is composed of five parts of nitrous acid and one part of marine acid: to eight ounces of this aqua regia, are added sixteen ounces of distilled water. Some leaves of Malacca tin, about the size and thickness of a sixpence, are then put into this diluted aqua regia, till it will dissolve no more of them: which operation our author observes, requires commonly twelve or fourteen days; though it might probably be hastened by beating the tin still thinner, and then rolling it into the form of a hollow cylinder, or turning it round into spiral convolutions, and thus exposing a greater extent of surface to the action of the menstruum. In order to prepare more readily the precipitate of Cassius, M. Fontanieu puts into a large jug eight ounces of solution of tin, to which he adds four pints of distilled water: he afterwards pours into this metallic lye some solution of gold, drop by drop, taking care to stir the whole with a glass tube: when the mixture becomes of a deep purple colour, he ceases dropping the solution of gold; and in order to hasten the precipitation of the mineral purple, pours into the mixture a pint of fresh urine. Six or seven hours after, the precipitate is collected at the bottom of the vessel: the fluid is then decanted; and the precipitate, washed once or twice, is dried till it becomes a brown powder.

2. Pour into a vessel of fine tin with a thick bottom four ounces of the solution of gold; three minutes after add two pints of distilled water. Let this mixture stand in the tin vessel during seven hours, taking care to stir it every hour with a glass tube; afterwards pour it into a conical glass jug, and add to it a pint of new urine: the mineral purple is soon precipitated, and then is to be washed and dried.

3. Distil in a glass retort placed in a bath of ashes, some gold dissolved in aqua regia, made with three parts nitrous and one part marine acid; when the acid is passed over and the gold contained in the retort appears dry, leave the vessel to cool, then pour into it some new aqua regia, and proceed to distil as before. Replace the aqua regia twice upon the gold, and distil the same. After these four operations, pour by little and little into the retort some oil of tartar *per deliquium*, which will occasion a brisk effervescence: when this ceases, distil the mixture till it becomes dry, and then put some warm water into the retort. Shake the whole and pour it into a cucurbit, when a precipitate is deposited, the colour of which is sometimes brown and sometimes yellow: After having washed this precipitate, dry it. Our author says, this mineral purple was much superior to the foregoing, since two grains of it only were sufficient to an ounce of the base, whilst it required of the other two a 20th part of the base. And he adds, that he found a means of exalting the colour of the precipitate of Cassius, by putting to it a sixth part of its weight of glass of antimony finely powdered, and of nitre in the proportion of a drachm to eight ounces of the base.

b, From *Silver.*] The oxide of silver, being vitrified, produces a yellowish gray colour. This oxide enters only into the composition of the yellow artificial diamond and the opal. M. Fontanieu introduces it into the base in the form of luna cornea.

In order to prepare it, he directs to dissolve the silver in precipitated nitrous acid, and afterwards to pour into it a solution of sea salt: a white precipitate is obtained; which, being washed and dried, melts very readily in the fire, and is soon volatilized if not mixed with vitrifiable matters. To make the yellow diamond, 25 grains of this luna cornea are put to an ounce of the fourth base: the dose of silver may be diminished according to the shade of yellow that one wishes to procure.

c, From *Copper.*] The oxide of copper imparts to white glass the finest green colour; but if this metal be not exactly in a state of oxide, it produces a brownish red colour. *Mountain blue verdigris*, and the residue of its distillation, are the different preparations of copper which our author employs to make the artificial emeralds.

d, From *Iron.*] Although it has been asserted that the oxides of iron introduce a very fine transparent red colour into white glass, M. Fontanieu could only obtain from it a pale red a little opake. The oxide of iron that he employed was in the proportion of the 20th part of the base.

There are several ways of preparing the oxide of iron called *crocus Martis*, or *saffron of Mars.* In general, it is necessary that this metal be so far oxidated that the magnet ceases to attract it: thus one may use the scales of iron found upon the bars of the furnaces which serve to distil aquafortis. By digesting filings of steel with distilled vinegar, then evaporating and replacing the vinegar 10 or 12 times upon these filings and drying them alternately, an oxide of iron is obtained, which must be sifted through a silk sieve, and then calcined. The oxide of iron thus obtained by the vinegar, our author says, only introduced into his bases a green colour inclining to a yellow.

By the following process a saffron of Mars of the finest red colour is obtained: Let an ounce of iron filings be dissolved in nitrous acid in a glass retort, and distilled over a sand bath to dryness. After having replaced the acid or the dry oxide, and re-distilled it a second and a third time, it is then edulcorated with spirits of wine, and afterwards washed with distilled water.

e, From the *Magnet.*] It is necessary to calcine the magnet before it be introduced into the vitrifications: Having therefore torrefied the magnet during two hours,

hours, it must be washed and dried. It is only employed in the composition of the opal.

f, From *Cobalt.*] The oxide of cobalt is only proper to introduce a blue colour into glass; but this semi-metal is rarely found free from iron and bismuth, and therefore it is first necessary to separate them from it. This is done by calcining the ore of cobalt in order to disengage the arsenic; afterwards the oxide must be distilled in a retort with sal ammoniac, and the iron and the bismuth are found sublimed with this salt. The distillation must be repeated with the sal ammoniac till this salt is no longer coloured yellow. The cobalt which remains in the cornute is then calcined in a potsherd, and becomes a very pure oxide; which being introduced into the base, in the proportion of a 900dth part, gives it a very fine blue colour, the intensity of which may be increased at discretion by the addition of oxide of cobalt. In order to prepare *black enamel* resembling that which is called *black agate* of Iceland; melt together a pound and a half of one of the bases, two ounces of the oxide of cobalt, two ounces of *crocus Martis* prepared with vinegar, and two ounces of manganese.

g, From *Tin.*] The oxide of tin, which is of a white colour, renders opake the glass with which it is melted, and forms white enamel. For this purpose, calcine the putty of tin; then wash and dry it, and sift it through a silk sieve. Take six pounds of the second base, the same quantity of the calcined putty of tin, and 48 grains of manganese.

h, From *Antimony.*] Antimony is only susceptible of vitrification in a certain state of oxidation, and then it produces a reddish or hyacinth coloured glass; but if the antimony be in a state of absolute calx, such as the diaphoretic antimony, then it is no longer vitrifiable, and may be substituted for oxide of tin to make white enamel. M. Fontanieu introduces the glass of antimony in the composition of artificial topazes. For the *oriental topaz*, he takes 24 ounces of the first base, and five drachms of the glass of antimony. To imitate the *topaz of Saxony*, he adds to each ounce of the base five grains of the glass of antimony. For the *topaz of Brazil*, he takes 24 ounces of the first base, one ounce 24 grains of glass of antimony, and 8 grains of the *precipitate of Cassius.*

i, From *Manganese.*] This mineral employed in a small quantity, renders the glass whiter; a larger quantity produces a very fine violet colour, and a still larger dose of it renders the glass black and opake.

There are two ways of preparing manganese. 1. The most simple consists in exposing it to a red heat, and then quenching it with distilled vinegar; it is afterwards dried and powdered, in order to pass it through a silk sieve. 2. Haudiquer de Blancour describes the second manner of preparing the manganese, proper to furnish a red colour, and names it *fusible manganese.* Take of manganese of Piedmont one pound; torrefy and pulverize it; then mix it with a pound of nitre, and calcine the mixture during 24 hours; afterwards wash it repeatedly in warm water, till the water of the lyes has no longer any taste; dry the manganese, and mix with it an equal weight of sal ammoniac; levigate this mixture on a slab of porphyry with oil of vitriol diluted with water to the strength of vinegar. Dry the mixture, and introduce it into a cornute; distil by a graduated fire; and when the sal ammoniac is sublimed weigh it, and add to the mixture an equal quantity. Then distil and sublime as before, and repeat the operation six times, being careful at each time to mix the sal ammoniac and the manganese upon the porphyry with diluted oil of vitriol.

At Tournhault in Bohemia, there is sold a fusible glass of a yellow colour, very like that of the topaz of Brazil, which, when exposed to a degree of fire in a cupel sufficient to redden it, becomes of a very fine ruby colour, more or less deep according to the degree of fire to which it has been exposed. Our author assayed this glass, and found it to contain a great deal of lead, but was not able to discover any gold in it.

III. *Of the different degrees of fire necessary for Factitious Gems.* Our author observes, that there are three degrees of heat very different in their energy. The fire kept up in the wind furnaces in the laboratories of chemists, is less active than that whose effect is accelerated by the means of bellows; and a fire supported by wood, and kept up during 60 hours without interruption, produces singular effects in vitrification, and renders the glass finer and less alterable.

When recourse is had to the forge, in order to operate a vitrification, it is necessary to turn about the crucible from time to time, that the mass may melt equally. Some coal also should be replaced, in proportion as it consumes towards the nozel of the bellows; for without this precaution, we should run the risk of cooling the crucible opposite to the flame, and probably of cracking it, when all the melted mass running among the coals would be totally lost. Though this is the readiest way of melting, it should not be employed out of choice; for the crucible often breaks, or coals get into it, which may reduce the lead to the metallic state.

The wind furnace is either square or round. A small cake of baked clay or brick, of the thickness of an inch, is placed upon the grate; and upon this cake is placed the crucible, surrounded with coals. The degree of heat produced by this furnace is much less than that of the forge: but in order to succeed in the vitrification, M. Fontanieu recommends the use of a furnace described by Kunckel, of which, the interior part is so disposed, that we may place crucibles at three different heights; and the name of *chambers* is given to those steps upon which the crucibles are placed.

It is obvious, that the degree of heat cannot be equal in the said three chambers. In the first or lowest chamber the heat is greatest, afterwards in the next, and lastly, in the highest. We should begin by placing the crucibles according to their size, in these different chambers; by which means the best effect in vitrification is produced.

In order to conduct the fire well, only three billets of white wood should be put into the furnace at a time for the first 20 hours, four billets at a time for the next 20 hours, and six billets for the last 30 hours; in all 60 hours. The furnace is then left to cool, care being taken to stop the air hole with some lute; and in about 48 hours after, when the kiln is quite cold, the crucible is to be withdrawn.

IV. *The Compositions.* 1. For the white diamond: Take

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Take the base of Mayence. This crystal is very pure, and has no colours.

2. For the yellow diamond: To an ounce of the fourth base, add for colour 25 grains of luna cornea or 10 grains of glass of antimony.

3. For the emerald: 1. To 15 ounces of either of the bases, add for colour one drachm of mountain blue and six grains of glass of antimony; or, 2. To an ounce of the second base, add for colour 20 grains of glass of antimony, and three grains of calx of cobalt.

4. For the sapphire: To 24 ounces of the Mayence base, add for colour two drachms 46 grains of the calx of cobalt.

5. For the amethyst: To 24 ounces of the Mayence base, add for colour four drachms of prepared manganese and four grains of precipitate of Cassius.

6. For the beryl: To 24 ounces of the third base, add for colour 96 grains of glass of antimony and four grains of calx of cobalt.

7. For the black agate: To 24 ounces of either of the bases, add two ounces of the mixture directed above in par. *f*.

8. For the opal: To an ounce of the third base, add for colour 10 grains of luna cornea, two grains of magnet, and 26 grains of absorbent earth.

9. For the oriental topaz: To 24 ounces of the first or third base, add for colour five drachms of glass of antimony.

10. For the topaz of Saxony: To 24 of the same base, add for colour six drachms of the glass of antimony.

11. For the topaz of Brasil: To 24 ounces of the second or third base, add for colour one ounce 24 grains of the glass of antimony and eight grains of precipitate of Cassius.

12. For the hyacinth: To 24 ounces of the base made with rock crystal, add for colour two drachms 48 grains of glass of antimony.

13. For the oriental ruby: 1. To 16 ounces of the Mayence base, add for colour a mixture of two drachms 48 grains of the precipitate of Cassius, the same quantity of crocus Martis prepared in aquafortis, the same of golden sulphur of antimony and of fusible manganese, with the addition of two ounces of mineral crystal: or, 2. To 20 ounces of the base made with flint, add half an ounce of fusible manganese and two ounces of mineral crystal.

14. For the balass ruby: 1. To 16 ounces of the Mayence base, add the above colouring powder, but diminished a fourth part; or, 2. To 20 ounces of the base made with flints, add the same colouring powder, but with a fourth less of the manganese.

The *factitious* gems are easily distinguished from the *natural*, by their softness and fusibility; by their solubility in acids; by their causing only a single refraction of the rays of light; and in many cases, by their specific gravity, which exceeds 2.76 in all precious gems of the first order, as the diamond, ruby, sapphire, &c.

Imitation of Antique GEMS. There has been at different times a method practised by particular persons of taking the impressions and figures of antique gems, with their engravings, in glass of the colour of the original gem. This has always been esteemed a very valuable method, and greatly preferable to the more ordinary ones of doing it on sealing wax or brimstone; but, to the misfortune of the world, this art being a secret only in the hands of some particular persons who got their bread by it, died with them, and every new artist was obliged to re-invent the method; till at length Mr Homberg having found it in great perfection, gave the whole process to the world to be no more forgotten or lost; and since that time it has been very commonly practised in France, and sometimes in other places.

Mr Homberg was favoured in his attempts with all the engraved gems of the king's cabinet; and took such elegant impressions, and made such exact resemblances of the originals, and that in glasses so artfully tinged to the colour of the gems themselves, that the nicest judges were deceived in them, and often took them for the true antique stones. The counterfeit gems also serve, as well as the original one, to make more copies from afterwards; so that there is no end of the numbers that may be made from one; and there is this farther advantage, that the copy may be easily made perfect, though the original should not be so, but should have sustained some damage from a blow or otherwise.

The great care in the operation is to take the impression of the gem in a very fine earth, and to press down upon this a piece of proper glass, softened or half melted at the fire, so that the figures of the impression made in the earth may be nicely and perfectly expressed upon the glass. In general, the whole process much resembles that of the common founders. But when it is brought to the trial, there is found a number of difficulties which were not to be foreseen, and which would not at all affect the common works of the founder. For this purpose, every earth will serve that is fine enough to receive the impressions, and tough enough not to crack in the drying: these all serve for their use, because the metals which they cast are of a nature incapable of mixing with earth, or receiving it into them, even if both are melted together, so that the metal always easily and perfectly separates itself from the mould; but it is very difficult in these casts of glass. They are composed of a matter which differs in nothing from that of the mould, but that it has been run into this form by the force of fire, and the other has not yet been so run, but is on any occasion ready to be so run, and will mix itself inseparably with the glass in a large fire: consequently, if there be not great care used, as well in the choice of the glass as in the manner of using it, when the whole is finished there will be found great difficulty in the separating the glass from the mould, and often this cannot be done without wholly destroying the impression.

All earths run more or less easily in the fire as they are more or less mixed with saline particles in their natural formation. As all salts make earths run into glass, and as it is necessary to use an earth on this occasion for the making a mould, it being also necessary to the perfection of the experiment that this earth should not melt or run, it is our business to search out for this purpose some earth which naturally contains very little salt. Of all the species of earth which Mr Homberg examined on this occasion, none proved so much

much divested of salts, or so fit for the purpose, as the common tripela, or TRIPOLI, used to polish glass and stones. Of this earth there are two common kinds: the one reddish, and composed of several flakes or strata; the other yellowish, and of a simple structure. These are both to be had in the shops. The latter kind is from the Levant; the former is found in England, France, and many other places. The tripela must be chosen soft and smooth to the touch, and not mixed with sandy or other extraneous matter. The yellowish kind is the best of the two, and is commonly called *Venetian tripoli*. This receives the impressions very beautifully; and never mixes with the glass in the operation, which the red kind sometimes does. Mr Homberg usually employed both kinds at once in the following manner: first powder a quantity of the red tripela in an iron mortar, and sifting it through a fine sieve set it by for use; then scrape with a knife, a quantity of the yellow tripela into a sort of powder, and afterwards rub it till very fine in a glass mortar with a glass pestle. The finer this powder is, the finer will be the impression, and the more accurately perfect the cast. The artificer might naturally suppose, that the best method to obtain a perfect fine powder of this earth would be by washing it in water; but he must be cautioned against this. There is naturally in this yellowish tripoli a sort of unctuosity, which when it is formed into a mould keeps the granules together, and gives the whole an uniform glossy surface: now the washing the powder takes away this unctuosity; and though it renders it much finer, it makes it leave a granulated surface, not this smooth one, in the mould; and this must render the surface of the cast less smooth.

When the two tripelas are thus separately powdered, the red kind must be mixed with so much water as will bring it to the consistence of paste, so that it may be moulded like a lump of dough between the fingers; this paste must be put into a small crucible of a flat shape, and about half an inch or a little more in depth, and of such a breadth at the surface as is a little more than that of the stone whose impression is to be taken. The crucible is to be nicely filled with this paste lightly pressed down into it, and the surface of the paste must be strewed over with the fine powder of the yellow tripela not wetted. When this is done, the stone, of which the impression is to be taken, must be laid upon the surface, and pressed evenly down into the paste with a finger and thumb, so as to make it give a strong and perfect impression; the tripela is then to be pressed nicely even to its sides with the fingers, or with an ivory knife. The stone must be thus left a few moments, for the humidity of the paste to moisten the dry powder of the yellow tripela which is strewed over it: then the stone is to be carefully raised by the point of a needle fixed in a handle of wood; and the crucible being then turned bottom upwards, it will fall out, and the impression will remain very beautifully on the tripoli.

If the sides of the cavity have been injured in the falling out of the stone, they may be repaired; and the crucible must then be set, for the paste to dry, in a place where it will not be incommoded by the dust.

The red tripoli being the more common and the cheaper kind, is here made to fill the crucible only to save the other, which alone is the substance fit for taking the impression. When the stone is taken out, it must be examined, to see whether any thing be lodged in any part of the engraving, because if there be any of the tripela left there, there will certainly be so much wanting in the impression. When the crucible and paste are dry, a piece of glass must be chosen of a proper colour, and cut to a size proper for the figure; this must be laid over the mould, but in such a manner that it does not touch the figures, otherwise it would spoil them. The crucible is then to be brought near the furnace by degrees, and gradually heated till it cannot be touched without burning the fingers; then it is to be placed on the furnace under a muffle, surrounded with charcoal. Several of these small crucibles may be placed under one muffle; and when they are properly disposed, the aperture of the muffle should have a large piece of burning charcoal put to it, and then the operator is to watch the process, and see when the glass begins to look bright; this is the signal of its being fit to receive the impression. The crucible is then to be taken out of the fire; and the hot glass must be pressed down upon the mould with an iron instrument to make it receive the regular impression: as soon as this is done, the crucible is to be set at the side of the furnace out of the way of the wind, that it may cool gradually without breaking. When it is cold, the glass is to be taken out, and its edges should be grated round with pincers, which will prevent its flying afterwards, which is an accident that sometimes happens when this caution has been omitted, especially when the glass is naturally tender. The different coloured glasses are of different degrees of hardness, according to their composition; but the hardest to melt are always the best for this purpose, and this is known by a few trials.

If it be desired to copy a stone in relief which is naturally in creux, or to take one in creux which is naturally in relief, there needs no more than to take an impression first in wax or sulphur, and to mould that upon the paste of tripela instead of the stone itself; then proceeding in the manner before directed, the process will have the desired success.

A more simple and easy method than the above, is by taking the casts in gypsum, or plaster of Paris as it is commonly called. For this purpose, the gypsum must be finely pulverized, and then mixed with clear water to the consistence of thick cream. This is poured upon the face of the gem or seal of which the impression is wanted, and which must be previously moistened with oil to facilitate the separation of the cast; and in order to confine the liquid plaster, it is only necessary to pin a slip of oiled paper round the sides of the seal by way of a cap or rim. When the plaster is dry, it is to be taken off, and set before the mouth of the furnace, in order to free it entirely from moisture; when it is fit to be used as a matrix in the same way as that formed with the tripoli earths. Only no crucible or other receptacle is at all necessary; the casts being formed like so many small cakes half an inch thick, and thus put into the furnace with bits of glass upon them. The glass, after coming to a proper heat, is pressed down upon the mould with an iron spatula to receive the desired impression, the pressure requisite being more or less according to the size of the stone. This method has been long practised very successfully, and with

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with no small emolument, by that ingenious seal engraver Mr Deuchar of Edinburgh. The only respect in which it is inferior to the other more operose and expensive methods, consists in the chance of air bubbles arising in pouring on the plaster; which chance, however, is less in proportion to the fineness of the gypsum employed. When air bubbles do occur, the casts may be laid aside, as it is so easy to replace them.

The application of pastes to multiply and preserve the impressions of camaieux and intaglios, is an object very interesting to artists and to antiquaries, as well as to men of learning and taste in the fine arts.

This art, though only lately restored in any degree of perfection, is of very considerable antiquity. The great prices which the ancients paid for the elegant gems engraved by the celebrated Greek artists, could not but early suggest to them the idea of multiplying their numbers, by taking off their impressions in wax, in sulphur, in plaster, or in clay; but more particularly in coloured glass, or that vitrified substance commonly called *paste*.

As the impressions on paste are durable, and imitate the colours and brilliancy of the original stones, they serve the same purposes as the gems themselves. This art was therefore practised not only by the Greeks, but by all the nations who cultivated Grecian taste.

Many of the finest gems of antiquity are now lost, and their impressions are to be found only on ancient pastes. Great therefore is the value of these pastes. Numerous collections of them have been formed by the curious. Instances of this are found in the Florentine Musæum, in Stosch's work on ancient gems with inscriptions, in Winkelmann's description of Stosch's cabinet, and in the noble collection of Mr Charles Townley in London.

The art of taking impressions of gems seems not to have been altogether lost even in the Gothic ages; for Heraclius, who probably lived in the ninth century, and wrote a book *De coloribus et artibus Romanorum*, teaches in very plain though not elegant terms how to make them. Indeed, some of the few persons who then possessed this art, taking advantage of the ignorance of the times, sold pastes for original gems. Thus the famous emerald of the abbey of Reichnaw near Constance, although a present made by Charlemagne, is now found to be a piece of glass. And thus the celebrated emerald vase in the cathedral of Genoa is likewise found to be a piece of paste (A). The Genoese got this vase at the taking of Cesarea in the year 1101 as an equivalent for a large sum of money; nor was any imposition then suspected, for in the year 1319 they pawned it for 1200 merks of gold.

But this ingenious art, revived indeed in Italy in the time of Laurence of Medici and Pope Leo X. was not cultivated in an extensive manner till the beginning of the present century, when M. Homberg restored it, as already mentioned. In this he is said to have been greatly assisted and encouraged by the then duke of Orleans regent of France, who used to amuse himself with that celebrated chemist in taking off impressions in paste from the king of France's, from his own, and other collections of gems.

According to the French Encyclopedists, M. Clachant the elder, an engraver of some note, who died at Paris in 1781, learned this art from his royal highness, to whose household his father or he seems to have belonged. Mademoiselle Feloix next cultivated this art, and it is believed still carries it on. She had been taught by her father, who in quality of garçon de chambre to the regent had often assisted in the laboratory of his master, where he acquired this knowledge. Her collection consists of 1800 articles.

Baron Stosch, a Prussian, who travelled over Europe in quest of original engraved stones and impressions of ancient gems for the elegant work which he published and Picart engraved (B), was well acquainted with this art. He had taught it to his servant Christian Dehn, who settled at Rome, where he made and sold his well known sulphur impressions and pastes. He had collected 2500 articles. Dolce has arranged them in a scientific order, and given a descriptive catalogue of them.

It was chiefly from Dehn's collection that the taste for sulphurs and pastes has become so universal. They are great objects of study, and often require much learning to explain them. They have unquestionably served to extend and improve the art of engraving on stones; and have been of infinite use to painters, to statuaries, and to other artists, as well as to men of classical learning and fine taste.

It is very difficult to take off impressions, and perfectly to imitate various-coloured cameos. It cannot be properly done in wax, sulphur, plaster, or glass of one colour only. The difficulties arising from their size and form, and from the various nature of the different sorts of glass which do not well unite into different strata, are very numerous: nor could the completest success in this chemical and mechanical branch of the art produce a tolerable cameo. Impressions or imitations, if unassisted by the tool of the engraver, do not succeed: because the undercutting and deep work of most of the originals require to be filled up with clay or wax, that the moulds may come off safe without injuring them. Hence the impressions from these moulds come off hard and destitute of delicacy, sharpness, and precision of outline, till the underworking of the moulder is cut away. But Mr Reiffenstein at Rome, by his genius, perseverance, and the assistance of able artists, has overcome these difficulties; and has had the satisfaction of succeeding, and producing variegated cameos which can hardly be distinguished from the originals.

Mr Lippart of Dresden, an ingenious glazier, and an enthusiast in the fine arts, practised this branch not unsuccessfully; but not finding sufficient encouragement for his pastes of coloured glass, or perhaps from local difficulties in making them well and cheap, he abandoned

(A) See M. de la Condamine's Diss. in Memoir. de l'Acad. Roy. de Paris, 1757.

(B) Gemmæ antiquæ coloratæ, sculptorum nominibus insignitæ, ære incisæ per Bernardum Picart. Amstelodam. 1724, folio.

doned this art. He substituted in its place impressions of fine white alabaster or selenite plaster. Such impressions, when carefully soaked in a solution of white Castile soap, then dried, and rubbed over with a soft brush, take a very agreeable polish. They show the work perhaps to better advantage than red or white sulphurs do; but they are not so durable, and are liable to be defaced by rubbing.

Of these impressions Mr Lippart published three different collections, each of them containing 1000 articles; and to the merit of having increased the number of Madamoiselle Feloix and Christiano Dehn's collections, which are all inserted in his, he added that of employing two learned Germans to arrange and describe them. The first thousand were arranged and described by the late Professor Christ at Leipsic, and the second and third thousand by Professor Heine at Goettingen. Nor did Mr Lippart stop here: but to make the study of antiquity more easy and acceptable to artists, he selected out of the whole collection of 3000, a smaller one of 2000 of the best and more instructive subjects, of which he himself drew up and published a description in German.

But of all the artists and ingenious men who have taken impressions of engraved gems in sulphur and in paste, no one seems to have carried that art to such perfection as Mr James Tassie, a native of Glasgow, who resided in London from the year 1766 till his death. His knowledge in various branches of the fine arts, particularly in that of drawing, naturally led him to it. The elegant portraits which he modelled in wax, and afterwards moulded and cast in paste, and which entirely resemble cameos, are well known to the public.

Mr Tassie, profiting of all the former publications of this sort, and by expence, industry, and access to many cabinets in England and other kingdoms to which former artists had not obtained admission, was enabled to increase his collection of impressions of ancient and modern gems to the number of above 15,000 articles. It is the greatest collection of this kind that ever existed; and serves for all the purposes of artists, antiquaries, scholars, men of taste, and even philosophers. The great demand for his pastes was perhaps owing in the beginning to the London jewellers, who introduced them into fashion by setting them in rings, seals, bracelets, necklaces, and other trinkets.

The reputation of this collection having reached the empress of Russia, she was pleased to order a complete set; which being accordingly executed in the best and most durable manner, were arranged in elegant cabinets, and are now placed in the noble apartments of her imperial majesty's superb palace at Czarsko Zelo.

Mr Tassie, in executing his commission, availed himself of all the advantages which the improved state of chemistry, the various ornamental arts, and the knowledge of the age, seemed to afford. The impressions were taken in a beautiful white enamel composition, which is not subject to shrink or form air bladders; which emits fire when struck with steel, and takes a fine polish; and which shows every stroke and touch of the artist in higher perfection than any other substance. When the colours, mixed colours, and nature of the respective originals, could be ascertained, they were imitated as completely as art can imitate them; insomuch that many of the paste intaglios and cameos in this collection are such faithful imitations, that artists themselves have owned they could hardly be distinguished from the originals. And when the colour and nature of the gems could not be authenticated, the pastes were executed in agreeable, and chiefly transparent, colours; constant attention being bestowed to preserve the outlines, extremities, attributes, and inscriptions.

It was the learned Mr Raspe (from whom this account (c) is taken) who arranged this great collection, and made out the descriptive catalogue. His arrangement is nearly the same with that of the late Abbé Winkelmann, in his decription of the gems which belonged to Baron Stosch. But as modern works were inserted in this collection, he found it necessary to make a few alterations, and added some divisions to those of M. Winkelmann, as will appear from the following conspectus, with which we shall conclude this detail.

I. Ancient Art and Engravings.
- Egyptian hieroglyphics, sacred animals, divinities, priests.
- Basilidian, Gnostic, and other talismans, &c.
- Oriental and barbarous ancient and modern engravings.
- Greek and Roman original copies, and imitations (the Etruscan are classed with the Greek works).
- A, Mythology or fabulous age. Gods, inferior divinities, religious ceremonies.
- B, Heroic age before the siege of Troy.
- C, Siege of Troy.
- D, Historic age. Of Carthage, Greece, Rome, subjects unknown.
- E, Fabulous animals and chimeras.
- F, Vases and urns.

II. Modern Art and Engravings.
- A, Religious subjects.
- B, Portraits of kings and sovereigns.
- C, Portraits of illustrious men in alphabetical order.
- D, Portraits unknown.
- E, Devices and emblems.
- F, Cyphers, arms, supporters, and medley of modern history.

GEMAPPE, a village of Austrian Hainault, three miles west-by-south of Mons, rendered memorable for a victory which the French under General Dumourier obtained over the Austrians, Nov. 5. 1792; in which the carnage on both sides was so dreadful, that three coal pits in the vicinity were filled up with the dead bodies of men and horses.

GEMARA, or GHEMARA, the second part of the TALMUD.

The

(c) Account of the present state and arrangement of Mr James Tassie's collection of pastes and impressions from ancient and modern gems, by R. C. Raspe, London, 1786, 8vo.

Gemara ‖ Geminiani.

The word גמרה *gemara*, is commonly supposed to denote a supplement; but in strictness it rather signifies complement, perfection: being formed of the Chaldee גמר, *gemar*, or *ghemer*, "to finish, perfect, or complete any thing."

The rabbins call the Pentateuch simply the *law*: the first part of the Talmud, which is only an explication of that law, or an application thereof to particular cases, with the decisions of the ancient rabbins thereon, they call the *Mischna*, i. e. "second law:" and the scond part, which is a more extensive and ample explication of the same law, and a collection of decisions of the rabbins posterior to the Mischna, they call *Gemara*, q. d. "perfection, completion, finishing;" because they esteem it the finishing of the law, or an explication beyond which there is nothing farther to be desired.

The Gemara is usually called simply *Talmud*, the common name of the whole work. In this sense we say, there are two Gemaras or Talmuds; that of Jerusalem and that of Babylon: though in strictness the Gemara is only an explication of the Mischna, given by the Jewish doctors in their schools: much as the commentaries of our school divines on St Thomas, or the master of the sentences, are an explication of the writings of those authors.

A commentary, Mons. Tillemont observes, was wrote on the Mischna, by one Johanan, whom the Jews place about the end of the second century; but Fa. Morin proves, from the work itself, wherein mention is made of the Turks, that it was not wrote till the time of Heraclius, or about the year 620; and this is what is called the *Gemara*, or *Talmud of Jerusalem*, which the Jews do not use or esteem much because of its obscurity.

They set a much greater value on the Gemara, or Talmud of Babylon, begun by one Asa; discontinued for 73 years, on occasion of the wars with the Saracens and Persians; and finished by one Josa, about the close of the seventh century. See TALMUD.

Though the name Talmud, in its latitude, includes both the Mischna and the two Gemaras, yet it is properly that of Asa and Josa alone which is meant under that name. This the Jews prize above all their other writings, and even set it on a level with Scripture itself: in effect, they conceive it as the word of God, derived by tradition from Moses, and preserved without interruption to their time. R. Jehuda, and afterwards R. Johanan, R. Asa, and R. Josa, fearing the traditions should be lost in the dispersion of the Jews, collected them into the Mischna and the Gemara. See CARAITES and RABBINISTS.

GEMINI, in *Astronomy*, the TWINS; a constellation or sign of the zodiac, the third in order, representing Castor and Pollux; and it is marked thus, ♊. The stars in the sign Gemini, in Ptolemy's catalogue, are 25; in Tycho's, 25; in Hevelius's, 38; in the Britannic catalogue, 85.

GEMINIANI, a celebrated musician and composer, was born at Lucca in the year 1680. He received his first instructions in music from Alessandro Scarlatti; and after that became a pupil of Carlo Ambrosio Lunati, surnamed *Il Gobbo*, a most celebrated performer on the violin; after which he became a disciple of Corelli, and under him finished his studies on that instrument. In the year 1714 he came to England; where in a short time he so recommended himself by his exquisite performance, that all who professed to love and understand music were captivated with hearing him.—Many of the nobility laid claim to the honour of being his patrons; but he seemed chiefly to attach himself to Baron Kilmansegge, chamberlain to King George I. as elector of Hanover, and a favourite of that prince. In 1716, he published and dedicated to his patron 12 sonatas *a violino violone e cembalo*: the first six with fugues, or double stops as they are vulgarly called; the last with airs of various measures, such as allemandes, courantes, and jiggs. This publication was so well relished by the baron, that he mentioned Geminiani to the king as an excellent performer; in consequence of which our musician had the honour to perform before his majesty, in concert with the celebrated Handel, who played on the harpsichord. But though Geminiani was exceedingly admired, yet he had not a talent at associating music with poetry, nor do we find that he ever became a public performer: he was therefore obliged to depend for his subsistence on the friendship of his patrons and the profits which accrued to him from teaching. He had also the misfortune to be an enthusiast in painting; and the versatility of his temper was such, that, in order to gratify this passion, he not only suspended his studies, and neglected to exercise his talents, but involved himself in debts. In 1727, he was offered the place of master and composer of the state music in Ireland; but this could not be conferred on a Catholic, and Geminiani refused to change his religion: upon which it was given to Matthew Dubourg, a young man who had been one of his pupils, and was a celebrated performer on the violin. Geminiani then set himself to compose parts to the *opera quinta* of Corelli; or, in other words, to make concertos of the first six of his solos. This work he completed, and, with the help of a subscription, at the head of which were the names of the royal family, published in 1726. In 1732, he published his *opera seconda*, which contains a celebrated minuet that goes by his name. He published many other pieces, the profits of which did not much mend his circumstances; but this perhaps was owing to his rambling disposition and enthusiastic fondness of painting. He was also an utter stranger to the business of an orchestra, and had no idea of the labour and pains necessary in the instruction of singers for the performance of music to which they were strangers. The consequence of this was, that a *concerto spirituale*, which he had advertised for his own benefit in 1748, failed in the performance. The audience, however, compassionated his distress, and sat very silent till the books were changed; when the performance was continued with compositions of the author's own, and which he executed in such a manner as was never forgotten. The profits arising from this performance enabled him to take a journey to Paris; where he staid long enough to get plates engraven for a score of solos, and the parts of two operas of concertos. About the year 1755 he returned to England, and advertised them for sale.—In 1761 Geminiani went over to Ireland; and was kindly entertained there by Mr Matthew Dubourg, who had been his pupil, and was then master of the king's band in Ireland. This person through the course

course of his life had ever been disposed to render him friendly offices; and it was but a short time after Geminiani's arrival at Dublin that he was called upon to do him the last. It appears that Geminiani had spent many years in compiling an elaborate treatise on music, which he intended for publication; but soon after his arrival at Dublin, by the treachery of a female servant, who, it was said, was recommended to him for no other end than that she might steal it, it was conveyed away, and could not be recovered. The greatness of this loss, and his inability to repair it, made a deep impression on his mind; and, as it is conjectured, hastened his end; at least he survived it but a short time, ending his days on the 17th of September 1762. The following list comprises the whole of his publications, except two or three articles of small account: Twelve solos for a violin, *opera prima;* six concertos in seven parts, *opera seconda;* six concertos in seven parts, *opera terza;* twelve solos for a violin, *opera quarta;* six solos for a violoncello, *opera quinta;* the same made into solos for a violin: six concertos from his *opera quarta;* six concertos in eight parts, *opera settima;* rules for playing in taste; a treatise on good taste; the art of playing the violin; 12 sonatas from his first solos, *opera undecima;* Ripieno parts to ditto; lessons for the harpsichord; *Guido Armonica;* supplement to ditto; the art of accompaniment, two books; his first two operas of concertos in score; and the Enchanted Forest.—Of his solos the *opera prima* is esteemed the best. Of his concertos some are excellent, others of them scarce pass the bounds of mediocrity. The sixth of the third opera not only surpasses all the rest, but, in the opinion of the best judges of harmony, is the finest instrumental composition extant.

GEMMA, or Bud, in *Botany:* a compendium or epitome of a plant, seated upon the stem and branches, and covered with scales, in order to defend the tender rudiments enclosed from cold and other external injuries, till, their parts being unfolded, they acquire strength, and render any further protection unnecessary.

Buds, together with bulbs, which are a species of buds generally seated upon or near the root, constitute that part of the herb called by Linnæus *hybernacula;* that is, the winter quarters of the future vegetable: a very proper appellation, as it is during that severe season that the tender rudiments are protected in the manner just mentioned.

Plants, considered in analogy to animals, may probably enough be reckoned both viviparous and oviparous. Seeds are the vegetable eggs; buds, living fetuses, or infant plants, which renew the species as certainly as the seeds.

Buds are placed at the extremity of the young shoots, and along the branches, being fixed by a short footstalk upon a kind of brackets, the remainder of the leaves, in the wings or angles of which the buds in question were formed the preceding year. They are sometimes placed single; sometimes two by two, and those either opposite or alternate; sometimes collected in greater numbers in whirls or rings.

With respect to their construction, buds are composed of several parts artificially arranged. Externally, we find a number of scales that are pretty hard, frequently armed with hairs, hollowed like a spoon, and placed over each other like tiles. These scales are fixed into the inner plates of the bark, of which they appear to be a prolongation. Their use is to defend the internal parts of the bud; which, being unfolded, will produce, some, flowers, leaves, and stipulæ; others, footstalks and scales. All these parts, while they remain in the bud, are tender, delicate, folded over each other, and covered with a thick clammy juice, which is sometimes resinous and odoriferous, as in the tacamahac tree. This juice serves not only to defend the more tender parts of the embryo plant from cold, the assaults of insects, and other external injuries; but likewise from excessive perspiration, which, in its young and infant state, would be very destructive. It is conspicuous in the buds of horse chesnut, poplar, and willow trees.

In general, we may distinguish three kinds of buds; that containing the flower, that containing the leaves, and that containing both flower and leaves.

The first, termed *gemma florifera*, and by the French *bouton à fleur* or *à fruit*, contains the rudiments of one or several flowers, folded over each other, and surrounded with scales. In several trees, this kind of bud is commonly found at the extremity of certain small branches, which are shorter, rougher, and less garnished with leaves, than the rest. The external scales of this species of bud are harder than the internal; both are furnished with hairs, and in general more swelled than those of the second sort. The bud containing the flower too is commonly thicker, shorter, almost square, less uniform, and less pointed; being generally terminated obtusely. It is called by Pliny *oculus gemmæ;* and is employed in that species of grafting called *inoculation*, or *budding*.

The second species of bud, viz. that containing the leaves, termed *gemma folifera*, and by the French *bouton à feuilles* or *à bois*, contains the rudiments of several leaves, which are variously folded over each other, and outwardly surrounded by scales, from which the small stipulæ that are seated on the foot of the young branches are chiefly produced. These buds are commonly more pointed than the former sort. In the hazel nut, however, they are perfectly round; and in horse chesnut, very thick.

The third sort of bud is smaller than either of the preceding; and produces both flowers and leaves, though not always in the same manner. Sometimes the flowers and leaves are unfolded at the same time. This mode of the flower and leaf bud is termed by Linnæus *gemma folifera et florifera*. Sometimes the leaves proceed or emerge out of this kind of bud upon a small branch, which afterwards produces flowers. This mode of the flower and leaf bud is termed by Linnæus *gemma folifera florifera*, and is the most common bud of any.

Such buds as produce branches adorned only with leaves, are called *barren;* such as contain both leaves and flowers, *fertile*. From the bulk of the bud we may often with ease foretel whether it contains leaves only, or leaves and flowers together, as in cherry and pear trees.

Neither the buds produced on or near the root, called by some authors *turiones*, nor those produced on the trunk, and from the angles or wings of the leaves, contain, in strict propriety, an entire delineation of the plant: since the roots are wanting; and in various buds, Gemma.

buds, as we have seen, shoots are contained with leaves only, and not with flowers: but as a branch may be considered as a part similar to the whole plant, and, if planted, would in process of revegetation exhibit or produce roots and flowers, we may in general allow, that the bud contains the whole plant, or the principles of the whole plant, which may be unfolded *ad libitum*; and thus resembles the seed, in containing a delineation of the future plant in embryo: for although the bud wants a radicle, or plumula, of which the seed is possessed, yet it would undoubtedly form one, if planted in the earth. But as the medullary part adhering to the bud is too tender, and by the abundance of juice flowing into it from the earth would be disposed to putrefaction, the buds are not planted in the soil, but generally inserted within the bark of another tree; yet placed so that the production of the marrow, or pith, adhering to them, may be inserted into the pith of the branch in which the fissure or cleft is made; by which means there is a large communication of juice. This propagation by gems or buds, called *inoculation*, is commonly practised with the first sort of buds above described.

From the obvious uses of the buds, we may collect the reason why the Supreme Author of nature has granted this sort of protection to most of the trees that are natives of cold climates: and, on the other hand, denied it to such as, enjoying a warm benign atmosphere, have not the tender parts of their embryo shoots exposed to injuries and depredations from the severities of the weather. Of this latter kind are the plants of the following list; some of them very large trees; others smaller woody vegetables, of the shrub and under-shrub kind: Citron, orange, lemon, cassava, mock orange, blad apple, shrubby swallow-wort, alaternus, shrubby geraniums, berry-bearing alder, Christ's thorn, Syrian mallow, boabab or Ethiopian sour gourd, justicia, mild sena, the acacias and sensitive plant, coral tree, stinking bean trefoil, medicago, oleander, viburnum, sumach, ivy, tamarisk, heath, Barbadoes cherry, lavatera, rue, shrubby nightshade, Guinea henweed, cypress, lignum vitæ, and savine, a species of juniper.

On annual plants, whose root as well as stalk perishes after a year, true buds are never produced; in their stead, however, are produced small branches, like a little feather, from the wings of the leaves, which wither without any farther expansion if the plants climb and have no lateral branches; but if, either by their own nature or from abundance of sap, the plants become branched, the ramuli just mentioned obtain an increase similar to that of the whole plant.

The same appearance obtains in the trees of warm countries, such as those enumerated in the above list, in which a plumula, or small feather, sends forth branches without a scaly covering; as, in such countries, this tender part requires no defence or protection from cold. A scaly covering then is peculiar to buds, as it protects the tender embryo enclosed from all external injuries. When we therefore speak of trees having buds that are naked or without scales, our meaning is the same as if we had said that they have no buds at all.

The buds that are to be unfolded the following year, break forth from the evolved buds of the present year, in such a manner as to put on the appearance of small eminences in the wings or angles of the leaves. These eminences or knots grow but little during the summer; as, in that season, the sap is expended on the increase of the parts of the plant: but in autumn, when the leaves begin to wither and fall off, the buds, placed on the wings, increase; and the embryo plant contained in the bud is so expanded, that the leaves and flowers, the parts to be evolved the following year, are distinctly visible. Thus in horse chesnut the leaves, and in cornel tree the flowers, are each to be observed in their respective buds.

As each bud contains the rudiments of a plant, and would, if separated from its parent vegetable, become every way similar to it; Linnæus, to show the wonderful fertility of nature, has made a calculation, by which it appears, that, in a trunk scarcely exceeding a span in breadth, 10,000 buds (that is, herbs) may be produced. What an infinite number, then, of plants might be raised from a very large tree!

Gemmatio.

GEMMATIO, from *gemma*, "a bud;" a term used by Linnæus, expressive of the form of the buds, their origin, and their contents. It includes both those properly called *buds*, and those which are seated at the roots, styled *bulbs*.

As to the origin of buds, they are formed either of the footstalks of the leaves, of stipulæ, or of scales of the bark. Their contents have been already discovered, in the preceding article, to be either flowers, leaves, or both.

GEMONIÆ SCALÆ, or *Gradus* GEMONII, among the Romans, was much the same as gallows or gibbet in England.—Some say they were thus denominated from the person who raised them; others, from the first criminals that suffered on them; and others, from the verb *gemo*, "I sigh or groan."

The *gradus gemonii*, according to Publius Victor or Sextus Rufus, was a place raised on several steps, from whence they precipitated their criminals; others represent it as a place whereon offenders were executed, and afterwards exposed to public view. The *gemoniæ scalæ* were in the tenth region of the city, near the temple of Juno. Camillus first appropriated the place to this use, in the year of Rome 358.

GENDARMES, or GENS D'ARMES, in the French armies, a denomination given to a select body of horse, on account of their succeeding the ancient gendarmes, who were thus called from their being completely clothed in armour; (see *Scots* GENDARMES, *infra*.) These troops were commanded by captain lieutenants, the king and the princes of the blood being their captains; the king's troop, besides a captain-lieutenant, had two sublieutenants, three ensigns, and three guidons.

Grand GENDARMES, latterly were a troop composed of 250 gentlemen; the king himself was their captain, and one of the first peers their captain-lieutenant, who had under him two lieutenants, three ensigns, three guidons, and other officers.

Small GENDARMES, were the Scots gendarmes, the queen's, the dauphin's, the gendarmes of Anjou, Burgundy, the English and Flemish gendarmes, having each a captain lieutenant, sub-lieutenant, ensign, guidon, and quarter-master.

Scots GENDARMES, were originally instituted by Charles VII. of France, about the middle of the 15th century,

century, and formed a part of his guard; in which station also they acted under other princes. It was their prerogative to take precedence of all the companies of the gendarmerie of France; and, on particular occasions, they even preceded the two companies of the king's mousquetaires. The sons of the Scottish monarchs were the usual captains of this company; and, after Mary's accession to the throne, its command belonged to them as a right. It was thence that James VI. made a claim of it for his son Prince Henry. This honour, and its emoluments, were also enjoyed by Charles I. and the next in command to this prince was Louis Stuart duke of Lennox. George Gordon marquis of Huntly, succeeded the duke of Lennox in the year 1624, and took the title of captain or commander in chief when Charles I. mounted the English throne. It is not certain whether Charles II. was ever captain of this company; but it was conferred on his brother the duke of York, who was captain of the Scots gendarmes till the year 1667, when he resigned his commission into the hands of the French king. Since that time no native of Great Britain has enjoyed this command. See *Scots* GUARDS.

All the different gendarmeries are now abolished, in consequence of the reforming systems that have lately taken place in France.

GENDER, among grammarians, a division of nouns, or names, to distinguish the two sexes.

This was the original intention of gender: but afterwards other words, which had no proper relation either to one sex or the other, had genders assigned them, rather out of caprice than reason; which is at length established by custom. Hence genders vary according to the languages, or even according to the words introduced from one language into another. Thus, *arbor* in Latin is feminine, but *arbre* in French is masculine; and *dens* in Latin is masculine, but *dent* in French is feminine.

The oriental languages frequently neglect the use of genders, and the Persian language has none at all.

The Latins, Greeks, &c. generally content themselves to express the different genders by different terminations; as *bonus equus*, "a good horse;" *bona equa*, "a good mare," &c. But in English we frequently go further, and express the difference of sex by different words: as boar, sow; boy, girl; buck, doe; bull, cow; cock, hen; dog, bitch, &c.—We have only about 24 feminines, distinguished from the males, by the variation of the termination of the male into *ess;* of which number are abbot, abbess; count, countess; actor, actress; heir, heiress; prince, princess, &c. which is all that our language knows of any thing like genders.

The Greek and Latin, besides the masculine and feminine, have the neuter, common, and the doubtful gender; and likewise the epicene, or promiscuous, which under one single gender and termination includes both the kinds.

GENEALOGY, an enumeration of a series of ancestors; or a summary account of the relations and alliances of a person or family, both in the direct and collateral line.

The word is Greek, γενεαλογια; which is formed of γενος, "race or lineage," and λογος, "discourse."

In divers chapters and military orders, it is required, that the candidates produce their genealogy, to show that they are noble by so many descents.

GENEALOGICA ARBOR, or *Tree of Consanguinity*, signifies a genealogy or lineage drawn out under the figure of a tree, with its root, stock, branches, &c. The genealogical degrees are usually represented in circles, ranged over, under, and aside each other. This the Greeks called *stemmata*, a word signifying crown, garland, or the like. See the articles CONSANGUINITY and DESCENT, and the plates there referred to.

GENEP, a strong town of Germany, in the circle of Westphalia, subject to the king of Prussia. E. Long. 4. 29. N. Lat. 51. 42.

GENERAL, an appellation given to whatever belongs to a whole genus.

GENERAL *Assembly*. See ASSEMBLY.

GENERAL *Charge*, in *Law*. See *CHARGE to enter Heir*.

GENERAL *Terms*, among logicians, those which are made the signs of general ideas. See LOGIC and METAPHYSICS.

GENERAL *Warrant*. See WARRANT.

GENERAL *of an Army*, in the art of WAR, he who commands in chief. See the article WAR, where his office and duties are particularly explained.

GENERAL *of the Artillery*. See ORDNANCE.

GENERAL *of Horse*, and GENERAL *of Foot*, are posts next under the general of the army, and these have upon all occasions an absolute authority over all the horse and foot in the army.

Adjutant GENERAL, one who attends the general, assists in council, and carries the general's orders to the army. He distributes the daily orders to the majors of brigade. He is likewise charged with the general detail of the duty of the army. The majors of brigade send every morning to the adjutant general an exact return, by battalion and company, of the men of his brigade. In a day of battle the adjutant general sees the infantry drawn up; after which, he places himself by the general, to receive any orders which may regard the corps of which he has the detail. In a siege, he orders the number of workmen demanded, and signs the warrant for their payment. He receives the guards of the trenches at their rendezvous, and examines their condition; he gives and signs all orders for parties. He has an orderly serjeant from each brigade of infantry in the line, to carry such orders as he may have occasion to send from the general.

Lieutenant GENERAL, is the next in command after the general; and provided he should die or be killed, the order is, that the oldest lieutenant general shall take the command. This office is the first military dignity after that of general. One part of their function is, to assist the general with their counsel: they ought therefore, if possible, to possess the same qualities with the general himself; and the more, as they often command armies in chief.

The number of lieutenant generals has been multiplied of late in Europe, in proportion as the armies have become numerous. They serve either in the field, or in sieges, according to the dates of their commissions. In battle, the oldest commands the right wing of the army, the second the left wing, the third the centre, the

General. the fourth the right wing of the second line, the fifth the left wing, the sixth the centre; and so on. In sieges, the lieutenant generals always command the right of the principal attack, and order what they judge proper for the advancement of the siege during the 24 hours they are in the trenches: except the attacks, which they are not to make without an order from the general in chief.

Lieutenant GENERAL *of the Ordnance*. See ORDNANCE.

Lieutenant GENERAL *of Artillery*, is, or ought to be, a very great mathematician, and an able engineer; to know all the powers of artillery; to understand the attack and defence of fortified places, in all its different branches; how to dispose of the artillery in the day of battle to the best advantage; to conduct its march and retreat; as also to be well acquainted with all the numerous apparatus belonging to the train, and to the laboratory, &c.

Major GENERAL, the next officer to the lieutenant general. His chief business is to receive orders from the general, or in his absence from the lieutenant general of the day; which he is to distribute to the brigade majors, with whom he is to regulate the guards, convoys, detachments, &c. On him rests the whole fatigue and detail of duty of the army roll. It is the major general of the day who is charged with the encampment of the army, who places himself at the head of it when they march, who marks out the ground of the camp to the quartermaster general, and who places the new guards for the safety of the camp.

The day the army is to march, he dictates to the field officers the order of the march, which he has received from the general, and on other days gives them the parole.

In a fixed camp he is charged with the foraging, with reconnoitring the ground for it, and posting the escorts, &c.

In sieges, if there are two separate attacks, the second belongs to him; but if there is but one, he takes, either from the right or left of the attack, that which the lieutenant general has not chosen.

When the army is under arms, he assists the lieutenant general, whose orders he executes.

If the army marches to an engagement, his post is at the head of the guards of the army, until they are near enough to the enemy to rejoin their different corps; after which he retires to his own proper post: for the major generals are disposed on the order of battle as the lieutenant generals are; to whom, however, they are subordinate, for the command of their divisions. The major-general has one aid-de-camp, paid for executing his orders.

GENERAL is also used for a particular march, or beat of drum; being the first which gives notice, commonly in the morning early, for the infantry to be in readiness to march.

GENERAL is likewise an appellation by which officers in law, in the revenues, &c. are distinguished; as *attorney general*, *solicitor general*, &c. *receiver general*, *comptroller general*, &c. See ATTORNEY, &c.

GENERAL is also used for the chief of an order of monks, or of all the houses and congregations established under the same rule. Thus we say, the general of the Franciscans, Cistertians, &c.

Generalissimo. GENERALISSIMO, called also *captain general*, and simply *general*, is an officer who commands all the military powers of a nation; who gives orders to all the other general officers; and receives no orders himself but from the king.

M. Balzac observes, that the cardinal de Richelieu first coined this word, of his own absolnte authority, upon his going to command the French army in Italy.

Generation. GENERATE, in *Music*, is used to signify the operation of that mechanical power in nature, which every sound has in producing one or more different sounds. Thus any given sonnd, however simple, produces along with itself, its octave, and two other sounds extremely sharp, viz. its twelfth above, that is to say, the octave of its fifth; and the other the seventeenth above, or, in other words, the double octave of its third major.

Whether we suppose this procreation of sounds to result from an aptitude in the texture and magnitude of certain particles in the air, for conveying to our ears vibrations that bear those proportions, one to another, as being determined at once by the partial and total oscillations of any musical string; or from whatever economy of nature we choose to trace it; the power of one sound thus to produce another, when in action, is said to *generate*. The same word is applied, by Signior Tartini and his followers, to any two sounds which, simultaneously heard, produce a third.

GENERATED, or GENITED, is used, by some mathematical writers, for whatever is produced, either in arithmetic, by the multiplication, division, or extraction of roots; or in geometry, by the invention of the contents, areas, and sides; or of extreme and mean proportionals, without arithmetical addition and subtraction.

GENERATING LINE, or FIGURE, in *Geometry*, is that which, by its motion of revolution, produces any other figure, plane or solid. See GENESIS.

GENERATION, in *Physiology*, the act of procreating and producing a being similar to the parent. See ANATOMY, N° 157.

GENERATION *of Fishes*. See COMPARATIVE *Anatomy*, N° 304, and ICHTHYOLOGY.

GENERATION *of Plants*. See BOTANY.

GENERATION *of Insects*. See COMPARATIVE *Anatomy*, p. 312, and ENTOMOLOGY, p. 234.

Parts of GENERATION. See ANATOMY, N° 157.

GENERATION, in *Mathematics*, is used for formation or production. Thus we meet with the generation of equations, curves, solids, &c.

GENERATION, in *Theology*. The Father is said by some divines to have produced his Word or Son from all eternity, by way of generation; on which occasion the word *generation* raises a peculiar idea: that procession, which is really effected in the way of understanding, is called *generation*, because, in virtue thereof, the Word becomes like to him from whom he takes this original; or, as St Paul expresses it, is the figure or image of his substance, i. e. of his being and nature. And hence it is, they say, that the second Person in the Trinity is called the Son.

GENERATION is also used, though somewhat improperly, for genealogy, or the series of children issued from the same stock. Thus the gospel of St Matthew commences with the book of the generation of Jesus Christ,

Christ, &c. The latter and more accurate translators, instead of *generation* use the word *genealogy*.

Generation is also used to signify a people, race, or nation, especially in the literal translations of the Scripture, where the word generally occurs wherever the Latin has *generatio*, and the Greek γενεσις. Thus, "A wicked and perverse generation seeketh a sign," &c. "One generation passes away, and another cometh," &c.

Generation is also used in the sense of an age, or the ordinary period of man's life. Thus we say, "to the third and fourth generation." In this sense historians usually reckon a generation the space of 33 years or thereabouts. See Age.

Herodotus makes three generations in a hundred years; which computation appears from the latter authors of political arithmetic to be pretty just.

GENERATOR, in *Music*, signifies the principal sound or sounds by which others are produced. Thus the lowest C for the treble of the harpsichord, besides its octave, will strike an attentive ear with its twelfth above, or G in alt, and with its seventeenth above, or E in alt. The C, therefore, is called their *generator*, the G and E its products or harmonics. But in the approximation of chords, for G, its octave below is substituted, which constitutes a fifth from the generator, or lowest C; and for E, is likewise substituted its fifteenth below, which, with the above-mentioned C, forms a third major. To the lowest notes, therefore, exchanged for those in alt by substitution, the denominations of products or harmonics are likewise given, whilst the C retains the name of their *generator*. But still according to the system of Tartini, two notes in concord, which when sounded produce a third, may be termed the *concurring generators* of that third. (See *Generation Harmonique, par M. Rameau;* see also that delineation of Tartini's system called The Power and Principles of Harmony.

GENERICAL name, in *Natural History*, the word used to signify all the species of natural bodies, which agree in certain essential and peculiar characters, and therefore all of the same family or kind; so that the word used as the generical name equally expresses every one of them, and some other words expressive of the peculiar qualities or figures of each are added, in order to denote them singly, and make up what is called the specific name. See Botany and *Natural History*.

GENESIS, the first book of the Old Testament, containing the history of the creation, and the lives of the first patriarchs.

The book of Genesis stands at the head of the Pentateuch. Its author is held to be Moses: it contains the relation of 2369 years, viz. from the beginning of the world to the death of Joseph. The Jews are forbidden to read the beginning of Genesis, and the beginning of Ezekiel, before 30 years of age.

The Hebrews call this book *Bereschith*, because it begins with that word, which in their language signifies *in principio*, or "in the beginning." The Greeks give it the name *Genesis*, Γενεσις, q. d. production, generation, because it begins with the history of the production or generation of all beings.

This book, besides the history of the creation, contains an account of the original innocence and fall of man; the propagation of mankind; the rise of religion; the general defection and corruption of the world; the deluge; the restoration of the world; the division and peopling of the earth; and the history of the first patriarchs to the death of Joseph. It was easy for Moses to be satisfied of the truth of what he delivers in this book, because it came down to him through a few hands; for from Adam to Noah there was one man, viz. Methuselah, who lived so long as to see them both: in like manner Shem conversed with Noah and Abraham; Isaac with Abraham and Joseph, from whom the records of this book might easily be conveyed to Moses by Amram, who was contemporary with Joseph.

Genesis, in *Geometry*, denotes the formation of a line, plane, or solid, by the motion or flux of a point, line, or surface. See Fluxions.

The genesis or formation, *e. gr.* of a globe or sphere, is conceived by supposing a semicircle to revolve upon a right line, drawn from one extreme thereof to the other, called its axis, or axis of circumvolution: the motion or revolution of that semicircle is the genesis of the sphere, &c.

In the genesis of figures, &c. the line or surface that moves is called the *describent;* and the line round which, or according to which, the revolution or motion is made, the *dirigent*.

GENET, Gennet, or *Jennet*, in the manege, denotes a small-sized well-proportioned Spanish horse.

To ride *à la genette*, is to ride after the Spanish fashion, so short, that the spurs bear upon the horse's flank.

GENETHLIA, in antiquity, a solemnity kept in memory of some person deceased.

GENETHLIACI, in *Astrology*, persons who erect horoscopes, or pretend to foretel what shall befal a man by means of the stars which presided at his nativity. The word is formed of the Greek γενεθλη, *origin, generation, nativity.*

The ancients called them *Chaldæi*, and by the general name *mathematici:* accordingly, the several civil and canon laws, which we find made against the mathematicians, only respect the *genethliaci* or astrologers.

They were expelled Rome by a formal decree of the senate; and yet found so much protection from the credulity of the people, that they remained therein unmolested. Hence an ancient author speaks of them as *hominum genus quod in civitate nostra semper et vetabitur et retinebetur.*

GENETTE, in *Zoology*. See Viverra, Mammalia *Index*.

GENEVA, a city of Switzerland, on the confines of France and Savoy, situated in 6° 9′ E. Long. and 46° 12′ 9″ N. Lat. It stands on the banks of the river Rhone, just at the place where the latter issues from the lake which takes its name from the city; and part of it is built on an island in the river. It is handsome, well fortified, and pretty large; the streets in general are clean and well paved, but the principal one is encumbered with a row of shops on each side between the carriage and foot-path. The latter is very wide, and protected from the weather by great wooden penthouses projecting from the roofs; which, though very convenient, give the street a dark and dull appearance. The houses are generally constructed of freestone, with basements of limestone; the gutters, spouts,

ridges,

Geneva. ridges, and outward ornaments, being made of tinned iron. Some of them have arched walks or piazzas in front. The place called *Treille* is very agreeable, being planted with linden trees, and commanding a fine prospect of the lake, with several ranges of rocks rising behind one another, some covered with vineyards and herbage, and others with snow, having openings between them. Immediately below Geneva the Rhone is joined by the Arve, a cold and muddy stream rising among the Alps, and deriving a considerable part of its waters from the Glaciers. The Rhone is quite clear and transparent, so that the muddy water of the Arve is distinguishable from it even after they have flowed for several miles together. There are four bridges over the Rhone before it joins the Arve; and from it the city is supplied with water by means of an hydraulic machine, which raises it 100 Paris feet above its level. The principal buildings are, 1. The maison de ville, or townhouse, a plain ancient edifice, with large rooms, in which the councils assemble, and public entertainments are held; and in one of them a weekly concert is held by subscription during the winter. The ascent to the upper story is not by steps but a paved acclivity: which, however, is so gentle, that horses and mules can go up to the top. 2. The church of St Peter's, formerly the cathedral, is an ancient Gothic building, with a modern portico of seven large Corinthian columns of red and white marble from Roche. The only thing remarkable in the inside is the tomb of Henry duke of Rohan. 3. The arsenal is in good order, and supplied with arms sufficient for 12,000 men. There are many ancient suits of armour; and the scaling ladders, lanthorns, hatchets, &c. used by the Savoyards in their treacherous attempt on the city in the year 1602, to be afterwards noticed, are here preserved. The magazines contain 110 cannon, besides mortars. 4. The hospital is a large handsome building, by which and other charities near 4000 poor people are maintained. 5. The fortifications on the side of Savoy are of the modern construction, but are commanded by some neighbouring grounds. On the side of France they are old fashioned, and at any rate are rather calculated to prevent a surprise than to sustain a regular siege. There are three gates, towards France, Savoy, and Switzerland; and the access to the lake is guarded by a double jetty and chain.

The territory belonging to this city contains about seven square leagues, and is divided into nine parishes; the town is by far the most populous in Switzerland, but less so than it was before the French revolution, the number of inhabitants being now about 22,800. It has a small district dependent on it, but this does not contain above 16,000. The adjacent country is extremely beautiful, and has many magnificent views arising from the different positions of the numerous hills and mountains with regard to the town and lake. The inhabitants were formerly distinguished into four classes, viz. citizens, burgesses, inhabitants, and natives; and since the revolution in 1782, a fifth class named *domicilius*, has been added, who annually receive permission from the magistrates to reside in the city. The citizens and burgesses alone, however, are admitted to a share in the government; those called *inhabitants* are strangers allowed to settle in the town with certain privileges; and the *natives* are the sons of those inhabitants, who possess additional advantages. The people are very active and industrious, carrying on an extensive commerce.

State of learning in Geneva. This city is remarkable for the number of learned men it has produced. The reformed doctrines of religion were very early received in it, being preached there in 1533 by William Farel and Peter Viret of Orbe, and afterwards finally established by the celebrated John Calvin. Of this reformer Voltaire observes, that he gave his name to the religious doctrines first broached by others, in the same manner that Americus Vesputius gave name to the continent of America, which had formerly been discovered by Columbus. It was by the assiduity of this celebrated reformer, and the influence that he acquired among the citizens, that a public academy was first established in the city, where he, Theodore Beza, and some of the more eminent first reformers, read lectures with uncommon success. The intolerant spirit of Calvin is well known; but little of it now appears in the government of Geneva: on the contrary, it is the most tolerating of all the estates in Switzerland, being the only one of them which permits the public exercise of the Lutheran religion. The advantages of the academy at Geneva are very conspicuous among the citizens at this day, even the lower class of them being exceedingly well informed; so that, according to Mr Coxe, there is not a city in Europe where learning is so generally diffused. "I received great satisfaction (says he) in conversing even with several tradesmen upon topics both of literature and politics; and was astonished to find in this class of men so uncommon a share of knowledge; but the wonder ceases when we are told that all of them were educated at the public academy." In this seminary the industry and emulation of the student are excited by the annual distribution of prizes to those who distinguish themselves in each class. The prizes consist of small medals, but are conferred with such solemnity as cannot fail to produce a striking effect on the minds of youth. There is also a public library to which the citizens have access, and which undoubtedly tends greatly to that universal diffusion of learning so remarkable among the inhabitants. It was founded by Bonnivard, remarkable for his sufferings in the cause of the liberties of his country. Having been a great antagonist of the dukes of Savoy, against whom he asserted the independence of Geneva, he had the misfortune at last to be taken prisoner, and was imprisoned for six years in a dungeon below the level of the lake, in the castle of Chillon, which stands on a rock in the lake, and is connected with the land by a drawbridge. In 1536 this castle was taken from Charles III. of Savoy by the canton of Berne, assisted by the Genevans, who furnished a frigate (their whole naval force) to besiege it by water. Bonnivard was now taken from his dungeon, where by constant walking backward and forward, his only amusement, he had worn a hollow in the floor which consisted of solid rock. Bonnivard considered the hardships he had endured as ties which endeared him to the city, and became a principal promoter of the reformation by the mild methods of persuasion and instruction. He closed his benefactions by the gift of his books and manuscripts, and bequeathing his fortune towards the establishment and support of the seminary. His works, which chiefly relate to the history

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history of Geneva, are still preserved with great care and reverence. The library contains 25,000 volumes, with many curious manuscripts, of which an account has been published by the reverend M. Sennebier the librarian, who has likewise distinguished himself by several literary works. Messrs Bonnet, Saussure, Mallet, and De Luc, are the other most distingnished literary geniuses of which Geneva can boast. The last is particularly remarkable for the perfection to which he has brought the barometer, and which is now so great, that very little seems possible to be done by any body else. His cabinet merits the attention of naturalists, as containing many rare and curious specimens of fossils, which serve to illustrate the theory of the globe. It may be divided into three parts: 1. Such as enable the naturalist to compare the petrifactions of animals and vegetables with the same bodies which are still known to exist in our parts of the globe. 2. To compare these petrifactions of animals with the same bodies which are known to exist in different countries. 3. To consider the petrifactions of those bodies which are no longer known to exist. The second part comprehends the stones under three points of view: 1. Those of the primitive mountains, which contain no animal bodies; 2. Those of the secondary mountains, which contain only marine bodies; 3. Those which contain terrestrial bodies. The third part contains the lavas and other volcanic productions; which are distinguished into two classes: 1. Those which come from volcanoes now actually burning; 2. Those from extinguished volcanoes.

Account of De Luc's cabinet.

History and government of Geneva.

In the time of Charles the Great, the city and territory of Geneva made part of his empire; and, under his successors, it became subject to the German emperors. By reason of the imbecility of these princes, however, the bishops of Geneva acquired such authority over the inhabitants, that the emperor had no other means of counterbalancing it than by augmenting the privileges of the people. In these barbarous ages also the bishops and counts had constant disputes, of which the people took the advantage; and by siding sometimes with one, and sometimes with the other, they obtained an extension of their privileges from both. The house of Savoy at length purchased the territory, and succeeded the counts with additional power: against them therefore the bishops and people united in order to resist their encroachments; and, during this period, the government was strangely complicated, by reason of the various pretensions of the three parties. The counts of Savoy, however, had at last the address to dissolve the union between the bishops and citizens, by procuring the episcopal see for their brothers, and even their illegitimate children; by which means their power became gradually so extensive, that towards the commencement of the 16th century, Charles III. of Savoy (though the government was accounted entirely republican) obtained an almost absolute authority over the people, and exercised it in a most unjust and arbitrary manner. Thus violent commotions took place; and the citizens became divided into two parties, one of which, viz. the patriots, were styled *Eidgenossen* or *confederates;* the partisans of Savoy being disgraced by the appellation of *Mamelucs* or *slaves*. The true period of Genevan liberty may therefore be considered as commencing with the treaty concluded with Berne and Friburg in the year 1526; in consequence of which the duke was in a short time deprived of his authority, the bishop driven from the city, and the reformed religion and a republican form of government introduced. A long war commenced with Savoy on this account; but the Genevans proved an overmatch for their enemies by their own bravery and the assistance of the inhabitants of Berne. In 1584, the republic concluded a treaty with Zurich and Berne, by which it is allied to the Swiss cantons. The house of Savoy made their last attempt against Geneva in 1602, when the city was treacherously attacked in the night time during a profound peace. Two hundred soldiers had scaled the walls, and got into the town before the alarm was given; but they were repulsed by the desperate valour of a few citizens, who perished in the encounter. A petard had been fastened to one of the gates by the Savoyards; but the gunner was killed before it could be discharged. The war occasioned by this treachery was next year concluded by a solemn treaty, which has ever since been observed on both sides: though the independence of Geneva was not formally acknowledged by the king of Sardinia till the year 1754.

The restoration of tranquillity from without, in consequence of the above treaty, was however soon followed by the flames of internal discord, so common in popular governments; so that during the whole of the last century the history of Geneva affords little more than an account of the struggles betwixt the aristocratical and popular parties. About the beginning of the present century the power of the grand council was become almost absolute; but in order to restrain its authority, an edict was procured in 1707 by the popular party, enacting, that every five years a general council of the citizens and burghers should be summoned to deliberate upon the affairs of the republic. In consequence of this law a general assembly was convened in 1712; and the very first act of that assembly was to abolish the edict by which they had been convened. A proceeding so extraordinary can scarcely be accounted for on the principles of popular fickleness and inconstancy. Rousseau, in his Miscellaneous Works, ascribes it to the artifices of the magistrates, and the equivocal terms marked upon the billets then in use. For the question being put, "Whether the opinion of the councils for abolishing the periodical assemblies should pass into a law?" the words *approbation* or *rejection*, put upon the billets by which the votes were given, might be interpreted either way. Thus, if the billet was chosen on which the word *approbation* was written, the opinion of the councils which rejected the assemblies was approved; and by the word *rejection*, the periodical assembly was rejected of course. Hence several of the citizens complained that they had been deceived, and that they never meant to reject the general assembly, but only the opinion of the councils.

In consequence of the abolition of the general assemblies, the power of the aristocratical party was greatly augmented; till at length the inhabitants exerting themselves with uncommon spirit and perseverance, found means to limit the power of the magistrates, and enlarge their own rights. In 1776, as Mr Cox informs us, the government might be considered as a mean betwixt

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4 Sketch of the government in 1776.

twixt that of the aristocratical and popular cantons of Switzerland. The members of the senate, or little council of 25, enjoyed in their corporate capacity several very considerable prerogatives. By them half the members of the great council were named; the principal magistrates were supplied from their own body; they convoked the great and general councils, deliberating previously upon every question which was to be brought before these councils. They were vested also with the chief executive power, the administration of finances, and had in a certain degree the jurisdiction in civil and criminal causes. Most of the smaller posts were likewise filled by them; and they enjoyed the sole privilege of conferring the burghership. These, and other prerogatives, however, were balanced by those of the great council and the privileges of the general council. The former had a right to choose the members of the senate from their own body; receiving appeals in all causes above a certain value, pardoning criminals, &c. besides which they had the important privilege of approving or rejecting whatever was proposed by the senate to be laid before the people.

The general council or assembly of the people is composed of the citizens and burghers of the town; their number in general amounting to 1500, though usually not more than 1200 were present; the remainder residing in foreign countries, or being otherwise absent. It meets twice a-year, chooses the principal magistrates, approves or rejects the laws and regulations proposed by the other councils, imposes taxes, contracts alliances, declares war or peace, and nominates half the members of the great council, &c. But the principal check to the power of the senate arose from the right of *re-election*, or the power of annually expelling four members from the senate at the nomination of the *syndics* or principal magistrates, and from the right of representation. The syndics are four in number, chosen annually from the senate by the general council; and three years elapse before the same members can be again appointed. In choosing these magistrates, the senate appointed from its own body eight candidates, from whom the four syndics were to be chosen by the general council. The latter, however, had it in their power to reject not only the first eight candidates, but also the whole body of senators in succession: in which case, four members of the senate retired into the great council: and their places were filled by an equal number from that council. With regard to the power of representation, every citizen or burgher has the privilege of applying to the senate in order to procure a new regulation in this respect, or of remonstrating against any act of the magistracy. To these remonstrances the magistrates were obliged to give an explicit answer; for if a satisfactory answer was not given to one, a second was immediately presented. The representation was made by a greater or smaller number of citizens according to the importance of the point in question.

5 Account of the revolution in 1782.

Since 1776, however, several changes have taken place. This right of *re-election*, which the aristocratical party were obliged to yield to the people in 1768, soon proved very disagreeable, being considered by the former as a kind of ostracism; for which reason they catched at every opportunity of procuring its abolition. They were now distinguished by the title of *negatives*, while the popular party had that of *representants*; and the point in dispute was the compilation of a new code of laws. This measure the negatives opposed, as supposing that it would tend to reduce their prerogatives; while, on the other hand, the representants used their utmost endeavours to promote it, in hopes of having their privileges augmented by this means. At last in the month of January 1777, the negatives were obliged to comply with the demands of their antagonists; and a committee for forming a new code of laws was appointed by the concurrence of the little, great, and general councils. The committee was to last for two years, and the code to be laid before the three councils for their joint approbation or rejection. A sketch of the first part of the code was presented to the little and great councils on the first of September 1779, that they might profit by their observations before it was presented to the general council. Great disputes arose; and at length it was carried by the negatives that the code should be rejected and the committee dissolved. The opposite party complained of this as unconstitutional, and violent disputes ensued; the issue of which was, that the great council offered to compile the code, and submit it to the decision of the public. This did not give satisfaction to the popular party, who considered it as insidious: the contentions revived with more fury than ever, until at length the negatives supposing, or pretending to suppose, that their country was in danger, applied to the guarantees, France, Zurich, and Berne, entreating them to protect the laws and constitution. This was productive of no good effect; so that the negatives found no other method of gaining their point than by sowing dissension among the different classes of inhabitants. The *natives* were discontented and jealous on acount of many exclusive privileges enjoyed by that class named *citizens*: they were besides exasperated against them for having, in 1770, banished eight of the principal natives, who pretended that the right of burghership belonged to the natives as well as to the citizens, and demanded that this right ought to be gratuitously conferred instead of being purchased. The negatives, in hopes of making such a considerable addition to their party, courted the natives by all the methods they could think of, promising by a public declaration that they were ready to confer upon them those privileges of trade and commerce which had hitherto been confined exclusively to the citizens. The designs of the negatives were likewise openly favoured by the court of France, and dispatches were even written to the French resident at Geneva to be communicated to the principal natives who sided with the aristocratic party. The attorney-general, conceiving this mode of interference to be highly unconstitutional, presented a spirited remonstrance; by which the French court were so much displeased, that they procured his deposition from his office; and thus their party was very considerably increased among the natives. The representants were by no means negligent in their endeavours to conciliate the favour of the same party, and even promised what they had hitherto opposed in the strongest manner, viz. to facilitate the acquisition of the burghership, and to bestow it as the recompense of industry and good behaviour. Thus two parties were formed among the natives themselves; and the dissensions becoming

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coming every day worse and worse, a general insurrection took place on the 5th of February 1781. A dispute, accompanied with violent reproaches, having commenced betwixt two neighbouring and opposite parties of natives, a battle would have immediately taken place, had it not been for the interposition of the syndics on the one side, and the chiefs of the representants on the other. The tumult was beginning to subside, when a discharge of musquetry was heard from the arsenal. Some young men who sided with the negatives, having taken possession of the arsenal, had fired by mistake upon several natives of their own party, and had killed one and wounded another. This was considered by the representants as the signal for a general insurrection, on which they instantly took up arms and marched in three columns to the arsenal; but finding there only a few young men who had rashly fired without orders, they permitted the rest to retire without molestation. In the opinion of some people, however, this affair was preconcerted, and the representants are said to have been the first aggressors.

The representants having thus taken up arms, were in no haste to lay them down. They took possession of all the avenues to the city; and their committee being summoned next morning by the natives to fulfil their engagements with respect to the burghership, they held several meetings with the principal negatives on that subject, but without any success: for though the latter readily agreed to an augmentation of the commercial privileges of the natives, they absolutely refused to facilitate the acquisition of the burghership. The committee, however, embarrassed and alarmed at the number and threats of the natives, determined to abide by what they had promised; drew up an edict permitting the natives to carry on trade, and to hold the rank of officers in the military associations; and conferred the burghership on more than 100 persons taken from the natives and inhabitants, and even from the peasants of the territory. This was approved by the three councils; the negatives, dreading the power of their adversaries, who had made themselves masters of the city, not daring to make their appearance.

Thus the popular party imagined that they had got a complete victory; but they soon found themselves deceived. They were prevailed upon by the deputies from Zurich and Berne (who had been sent to conciliate the differences) to lay down their arms; and this was no sooner done, than the same deputies declared the edict in favour of the natives to be null and illegal. The senate declared themselves of the same opinion; and maintained, that the assent of the councils had been obtained only through fear of the representants who were under arms, and whom none at that time durst oppose. The representants, exasperated by this proceeding, presented another remonstrance on the 18th of March 1782, summoning the magistrates once more to confirm the edict; but a month afterwards received the laconic answer, that "government was neither willing nor able to confirm it." The natives, now finding themselves disappointed in their favourite object at the very time they had such strong hopes of obtaining it, behaved at first like frantic people; and these transports having subsided, an universal tumult took place. The most moderate of the popular party endeavoured in vain to allay their fury, by dispersing themselves in different quarters of the city; and the citizens, finding themselves at last obliged either to abandon the party of the natives or to join them openly, hastily adopted the latter measure; after which, as none could now oppose them, the officers of the representants took possession of the town, and quelled the insurrection. Various negotiations were carried on with the negatives in order to prevail upon them to ratify the edict, but without success: on which a few of the magistrates were confined by the popular party along with the principal negatives; and as they justly expected the interference of France on account of what they had done, they resolved to prolong the confinement of the prisoners, that they might answer the purpose of hostages for their own safety. In the mean time the body of citizens, deceived by the pretences of the popular party, acted as if their power was already established and permanent. In consequence of this, they deposed several members of the great and little councils, appointing in their room an equal number of persons who were favourable to the cause of the representants. The great council thus new modelled, executed the edict for conferring the burghership upon a number of the natives; and appointed a committee of safety, composed of eleven members, with very considerable authority. By this committee, the public tranquillity was re-established; after which, the fortifications were ordered to be repaired; and the people were buoyed up by the most dangerous notions of their own prowess, and a confidence that France either durst not attack them or did not incline to do so. In consequence of this fatal error, they refused every offer of reconciliation which was made them from the other party; until at last troops were dispatched against them by the king of Sardinia and the canton of Berne; and their respective generals, Messrs de la Marmora and Lentulus, were ordered to act in concert with the French commander, M. de Jaucourt, who had advanced to the frontiers with a considerable detachment. The Genevans, however, vainly puffed up by a confidence in their own abilities, continued to repair their fortifications with indefatigable labour; the peasants repaired from all quarters to the city, offering to mount guard and work at the fortifications without any pay; women of all ranks crowded to the walls as to a place of amusement, encouraging the men, and even assisting them in their labour. The besiegers, however, advanced in such force, that every person of discernment foresaw that all resistance would be vain. The French general Jaucourt, on the 29th of June 1782, despatched a message to the syndics; in which he insisted on the following humiliating conditions: 1. That no person should appear on the streets under pain of military punishment. 2. That a certain number of citizens, among whom were all the chiefs of the representants, should quit the place in 24 hours. 3. That all arms should be delivered to the three generals. 4. That the deposed magistrates should be instantly re-established: And, lastly, That an answer should be returned in two hours. By this message the people were thrown into the utmost despair; and all without exception resolved to perish rather than to accept of terms so very disgraceful. They instantly hurried to the ramparts with a view of putting their resolution in

Geneva. in force; but in the mean time the syndics found means to obtain from the generals a delay of 24 hours. During this interval, not only men of all ages prepared for the approaching danger, but even women and children tore the pavement from the streets, carrying the stones up to the tops of the houses, with a view of rolling them down upon the enomy in case they should force their way into the town. About 80 women and girls, dressed in uniforms, offered to form themselves into a company for the defence of their country. The committee of safety accepted their services, and placed them in a barrack secured from the cannon of the besiegers. The negatives were greatly alarmed at this appearance of desperate resistance; and some of the most moderate among them endeavoured, but without success, to effect a reconciliation. At the hour in which it was expected that the attack would begin, the ramparts were filled with defenders: and though the most zealous of the popular party had calculated only on 3000, upwards of 5000 appeared in the public cause. The French general, however, justly alarmed for the prisoners, who were now in imminent danger, again prolonged the period proposed for the capitulation. By these repeated delays the ardour of the defendants began to abate. The women first began to figure to themselves the horrors of a town taken by assault, and given up to an enraged and licentious soldiery; many timid persons found means not only to disguise their own fears, but to inspire others with them under the pretence of prudence and caution: at last the committee of safety themselves, who had so strenuously declared for hostilities, entirely changed their mind. Being well apprized, however, that it would be dangerous for them to propose surrendering in the present temper of the people, they assembled the citizens in their respective circles, representing, that if the city should be attacked in the night, it would be no longer possible to convene them: for which reason they recommended to them that each circle should nominate several deputies with full authority to decide in their stead; adding, that they ought rather to appoint those persons who from their age and respectable character were capable of assisting their country by their advice, while others were defending it by their valour. Thus a new council, composed of about 100 citizens, was formed; in which the chiefs, by various manœuvres, first intimidating, and then endeavouring to persuade the members of the necessity of surrendering, at last found means to take the thoughts of the people entirely off the defence of the city, and engage them in a scheme of general emigration. A declaration was drawn up to be delivered to the syndics with the keys of the city, the chiefs summoned the principal officers from their posts, ordered the cannon of several batteries to be rendered unfit for service, and at last took care of themselves by quitting the town. The people were in the utmost despair; and left the town in such multitudes, that when the Sardinians entered it in the morning, they found it almost deserted. This was followed by the restoration of the former magistrates, a complete subjection of the popular party, and the establishment of a military government.

6
New constitution established.

The changes which took place on this occasion were as follow: 1. An abolition of the right of re-election. 2. The abolition of that right by which the general council nominated half the vacancies in the great council. 3. The right of remonstrating was taken from the citizens at large, and vested in 36 adjuncts, who might be present in the great council the first Monday of every month. They enjoyed a right of representation, and in consequence of that had a deliberative voice; but on the whole were so insignificant, that they were nicknamed *Les Images*, or "The shadows." 4. The introduction of the grabeau, or annual confirmation of the members of the senate and of the great council, vested entirely in the latter. By this law part of the authority both of the senate and general council was transferred to the great council; and by subjecting the senate to this annual revision; its power was greatly lessened, and it was made in fact dependent upon the general councils. 5. The circles or clubs in which it was customary to convene the citizens, and all public assemblies whatever, were prohibited; and so rigorously was this carried into execution, that the society of arts was prohibited from meeting. 6. The militia were abolished; firing at marks, even with bows and arrows, was prohibited; and the town, instead of being guarded by the citizens, was now put under the care of 1000 foreign soldiers, whose colonel and major were both to be foreigners. These troops were to take an oath of fidelity to the republic, and of obedience to the great council and the committee of war: but were under the immediate command and inspection of the latter, and subject to the superior controul of the former. 7. No person was permitted to bear arms, whether citizen, native, or inhabitant. 8. Several taxes were imposed without the consent of the general council; but in time to come it was provided, that every change or augmentation of the revenue should be submitted to that body. 9. Several privileges with regard to trade and commerce, formerly possessed by the citizens alone, were now granted both to citizens and inhabitants.

It is not to be supposed that this revolution would be agreeable to people who had such a strong sense of liberty, and had been accustomed to put such a value upon it, as the Genevans. From what has been already related, it might seem reasonable to conclude, that an almost universal emigration would have taken place: but after their resentment had time to subside, most of those who fled at first, thought proper to return; and, in the opinion of Mr Coxe, not more than 600 finally left their country on account of the revolution in 1782. The emigrants principally settled at Brussels and Constance, where they introduced the arts of printing linens and watchmaking. Soon after the revolution, indeed, a memorial, signed by above 1000 persons of both sexes, all of them either possessed of some property or versed in trade or manufactures, was presented to the earl of Temple, then lord lieutenant of Ireland, expressing a desire to settle in that kingdom. The proposal met with general approbation; the Irish parliament voted 50,000l. towards defraying the expences of their journey, and affording them a proper settlement in the island. Lands were purchased for 8000l. in a convenient situation near Waterford; part of New Geneva was actually completed at the expence of 10,000l.; a charter was granted with very considerable privileges; the standard of gold was alter-

Geneva.

ed for the accommodation of the watch manufacturers; and the foundation of an academy laid upon an useful and liberal plan. Seven Genevans landed in Ireland in the month of July 1783: but when the nation had expended near 30,000l. on the scheme, it was suddenly abandoned. This seems principally to have been owing to the delays necessarily occasioned in the execution of such a complicated plan; and in some degree also by the high demands of the Genevan commissioners, who required many privileges inconsistent with the laws of Ireland. By these delays the Genevans, whose character seems not to be *perseverance*, were induced to abandon the scheme, and return to their former place of residence. Even the few who had already landed, though maintained at the public expence, were discontented at not finding the new town prepared for their reception; and as those among the proposed emigrants who possessed the greatest share of property had already withdrawn their names, the remainder did not choose to remain in a country where they had not capital sufficient to carry on any considerable trade or manufacture. A petition was then presented by the Genevan commissioners, requesting that 10,000l. of the 50,000l. voted might be appropriated to the forming a capital: but as this had been voted for other purposes, the petition was of course rejected; in consequence of which, the Genevans relinquished the settlement by an address, and soon after quitted the island.

New revolution in 17[illegible]

The people of Old Geneva, though returned to their former place of abode, were far from being inclined to submit to the yoke with patience. They were obliged to pay heavy taxes for maintaining a military force expressly calculated to keep themselves in subjection: and so intolerable did this appear, that in a few years every thing seemed ready for another revolution. The success of this seemed more probable than that of the former, as France was not now in a condition to interfere as formerly. The general ferment soon rose to such a height, that government was obliged to call in the aid of the military to quell a tumult which happened in the theatre. This produced only a temporary tranquillity; another tumult took place on the 26th of January 1789, on account of the publication of an edict raising the price of bread a farthing per pound. On this the people instantly rose, plundered the bakers shops: and next day a carriage loaded with bread and escorted by soldiers was plundered in its way to the distribution office. The soldiers fired on the populace, by which one man was killed and another wounded: but the tumult still increasing, the soldiers were driven away; and the body of the deceased was carried in a kind of procession before the town house, as a monument of the violence and oppression of the aristocratic party. The magistrates in the mean time spent their time in deliberation, instead of taking any effectual method of quelling the insurrection. The people made the best use of the time afforded them by this delay of the magistrates; they attacked and carried two of the gates, dangerously wounding the commanding officer as he attempted to allay the fury of both parties. At last the magistrates despatched against them a considerable body of troops, whom they thought the insurgents would not have the courage to resist; but in this they found themselves deceived. The people had formed a strong barricade, behind which they played off two fire pumps filled with boiling water and soap lyes against the extremities of two bridges which the military had to cross before they could attack them. The commanding officer was killed and several of his men wounded by the discharge of small arms from windows; and the pavement was carried up to the tops of houses in order to be thrown down upon the troops if they should force the barricades and penetrate into the streets. The tumult in the mean time continued to increase, and was in danger of becoming universal; when the magistrates, finding it would be impossible to quell the insurgents without a great effusion of blood, were reduced to the necessity of complying with their demands. One of the principal magistrates repaired in person to the quarter of St Gervais, proclaimed an edict for lowering the price of bread, granted a general amnesty, and released all the insurgents who had been taken into custody. Thus a momentary calm was produced; but the leaders of the insurrection, sensible that the magistrates were either unable or unwilling to employ a sufficient force against them, resolved to take advantage of the present opportunity to procure a new change of government. A new insurrection, therefore, took place on the 29th of the month, in which the soldiers were driven from their post, disarmed, and the gates seized by the people. The magistrates then, convinced that all opposition was fruitless, determined to comply with the demands of their antagonists in their full extent; and the aristocratical party suddenly changing their sentiments, renounced in a moment that system to which they had hitherto so obstinately adhered. On the application of the solicitor general, therefore, for the recovery of the ancient liberties of the people, the permission of bearing arms, re-establishment of the militia, and of their circles or political clubs, the removal of the garrison from the barracks, and the recal of the representants who were banished in 1782; these moderate demands were received with complacency, and even satisfaction. The preliminaries were settled without difficulty, and a new edict of pacification was published under the title of *Modifications à l'Edition de* 1782, and approved by the senate, great council, and general council. So great was the unanimity on this occasion, that the modifications were received by a majority of 1321 against 52. The pacification was instantly followed by marks of friendship betwixt the two parties which had never been experienced before; the sons of the principal negatives frequented the circles of the burghers; the magistrates obtained the confidence of the people; and no monument of the military force so odious to the people will be allowed to remain. "The barracks of the town-house (says Mr Coxe) are already evacuated, and will be converted into a public library; the new barracks, built at an enormous expence, and more calculated for the garrison of a powerful and despotic kingdom than for a small and free commonwealth, will be converted into a building for the university. The reformation of the studies, which have scarcely received any alteration since the time of Calvin, is now in agitation. In a word, all things seem at present to conspire for the general good; and it is to be hoped that both parties, shocked at the recollection of past troubles, will continue on as friendly terms

Geneva. terms as the jealous nature of a free constitution will admit."

Geneva, as well as the whole of Switzerland, fell a victim to French rapacity in 1802. The following observations, made by a traveller on the spot, afford us some information of the consequences of this event to Geneva, of its degraded state, and of the manners of the inhabitants.

"The population of Geneva is about 24,000: moreover it contains at present between 1200 and 1400 French troops: the parties intermix but little, and have had no disputes, although they certainly regard each other with an eye of jealousy. The Genevans do the French soldiers the justice to say, that they have demeaned themselves in a very becoming manner during their residence here: they acknowledge themselves to be a conquered people, and dare not open their mouths, except to an Englishman, against the treacherous invaders of their country, and destroyers of their liberties.

"You are too well versed in the history of this people to require being told, that, notwithstanding their present humiliated condition, Freedom is the goddess they worship; and that, had there been any possibility of securing her from violation, they would gladly have bled before her altars. However various has been their success, in the different revolutions which have agitated this secluded state, the Genevans have uniformly evinced a courage which awed their enemies, and a determined bravery in defence of their rights, which in shewing that they prized them highly, gave proof that they were worthy to enjoy them.

"The territory of Geneva is comprehended in the *Department du Leman*, which department contains about 16 square leagues of land: its population is estimated at 609,000 persons. It is divided into three cantons or hundreds, the largest of which has Geneva for its capital, and contains about 75,000 souls, of which 10,000 only are Genevans, 20,000 are French, and the remainder are Savoyards. The prefet, as in all the other departments, is appointed by the First Consul, *durante beneplacito*. The care of the high roads and public walks, public finances, executive justice, military affairs, and passports, are under his immediate direction. All military appointments are given to Frenchmen: one general commands the town, and another the country. At the first moment of the revolution all the old magistrates were displaced, and since that time the civil officers have been elected by the citizens at large, consequently some are Frenchmen, and some Genevans: the present mayor is one of the latter: he is a gentleman of great respectability, and is much esteemed by both parties. Whenever a new code of laws shall be established in France, its operations will be extended over the territory of Geneva; but at present the people here retain their old laws with some trifling alterations only, rather the form than the substance: thus, the guillotine is now substituted for the gallows, and the punishments in general, without varying the degree, are inflicted according to the French manner.

"In their treaty with France, the Genevans stipulated, that their hospital should not be obliged to receive French soldiers: this hospital was founded in the early part of the last century, by some of the richest citizens, and is so well supported by legacies, and by annual subscriptions, that the fund enables the directors to expend two thousand louis a year. In contempt of this treaty, Bonaparte has insisted on the admission of French soldiers, for whose accommodation, however, he promised to pay a certain sum *per diem*: in contempt of his promise, again, he has withheld the payment! An hospital, however, is now preparing at Carouge, a village in Savoy, between Geneva and Grange Colonge, for Frenchmen, to which, it is expected, the soldiers will be removed in May or June. Here is also a general hospital, once the nunnery of St Clair; it was founded, together with many other useful institutions, by that celebrated reformer, John Calvin, who fled from the persecution of Francis I. and found an asylum in Geneva. The revenue arising from the estates of this hospital has, till within these last few years, been commensurate with its expences: but, for some time back, it has been found necessary to collect almost an additional fourth, in order to supply its disbursements: twice in the year the treasurer goes round to every house, and solicits the charitable contribution of its inmates.

"Prior to the last revolution, I learn, that 600,000 French livres discharged all the public expences: with this very trifling sum were paid the salaries of the magistrates, of the master of the town, of the master of the country, the expences of the academy, of repairing the roads, of cleaning and lighting the town; in short, these 600,000 livres were sufficient to defray all the ordinary expences of the government. Since that too memorable event, the citizens of Geneva have been assessed to the amount of 1,500,000 livres, the salaries of the inferior magistrates are in arrears, the roads are not kept in good repair, the town is very dimly lighted, and the streets, a few of the principal ones excepted, are left with all their dirty honours thick upon them! The inhabitants go so far as to assert, that, in consequence of the neglect which the public drains have suffered, they have been affected with fevers and other illnesses to which they had hitherto been strangers.

"I understand, that the revenue of Geneva, since it has been annexed to the republic of France, arises chiefly from the following sources.—An excise duty is laid on all provisions (wheat excepted), on wine and merchandise of every description, which is brought into Geneva: the annual produce of this tax is about 120,000 French livres; a land tax; a tax on doors and windows; a tax on the sale of estates; a heavy tax on the collateral inheritance of an estate—where the inheritance is lineal and immediate, the tax is moderate. To these taxes or contributions, as they are called, must be added *la contribution mobilière*, which is a small tax on personal property, and produces annually about 75,000 livres. The collectors of these taxes are appointed by the First Consul, and are paid very highly for their trouble: the prefet, and all the principal public officers, are very regularly paid, but those in a subordinate situation seldom get above one-third of their stipends.

"Divorces seem to be obtained here with too much facility. But, in the first place, as to marriages, they must be celebrated, according to the French law, before the municipality, at the maison de ville. Marriage in France, you know, is merely a civil ceremony, the parties being obliged to swear before an appointed magistrate, that they are of age, and that they have consented

consented to become man and wife. The Genevans, however, do not consider this ceremony as sufficient: but, as our Gretna Green couples, on their return to Britain, think it necessary, after the fervour of passion is abated, and the mercury is fallen, in the animal thermometer, something lower than *blood heat*, to have the holy rites performed with the solemnity prescribed by law; so the Genevans, in addition to the civil ceremony prescribed by the laws of the republic of France, voluntarily conform to the religious ordinance of their own church. If a woman leaves her husband, and refuses to return to his habitation, after being summoned by him for that purpose, he can repudiate her for disobedience*." The inhabitants, though obliged to submit to superior force, were always averse to the French yoke; and when the French garrison capitulated to the Austrian general Bubna, in December 1813, the restoration of the republic was instantly decreed. On the 12th September 1814, Geneva was admitted a member of the Swiss confederation, and a new constitution was framed, in which it was declared, that "no patricians or privileged classes are acknowledged by the state, but that all the Genevese are equal before the law." Public affairs are managed by the great council of 250 members, and by the smaller council of 28, the latter being the executive. The territory of Geneva, which was originally very small, was augmented by late treaties, and now contains 120 square miles, and 25,000 inhabitants.

* ...nth. M. 1802.

Geneva *Lake*. This lake is in the shape of a crescent; along the concave side of which Mr Coxe travelled 54 miles. Switzerland forms the hollow, and Savoy the convex part; the greatest breadth being about 12 miles. The country on the side of Savoy is full of high and craggy mountains; but from Geneva to the environs of Lausanne it slopes to the margin of the lake, and is very rich and fertile. The banks rise considerably in the neighbourhood of Lausanne, and form a most beautiful terrace, with a rapid descent a few miles beyond the town. A plain begins in the neighbourhood of Vevay, which continues for a great way beyond the end of the lake, but contracting towards the water by the approach of the mountains. The lake itself appears at a distance of a beautiful blue colour, and the water is very clear and transparent. Near Geneva the coast of the lake abounds with pebbles; between that city and Lausanne it is sandy; from thence to Chilon it is bounded by hard calcareous rocks; and the extremity of the shores is a marsh formed by mud collected from the river Rhone. The greatest depth of this lake found by M. de Luc is 160 fathoms. Here the birds called *tippet grebes* make their appearance in December, and retire in February to other places where they breed. They make floating nests of reeds; but as the lake of Geneva affords none of these, they are obliged to migrate to other places where they grow. Their skins are much esteemed, and sell for 12s. or 14s. each. The lake of Geneva, like all others situated between mountains, is subject to sudden storms.

Geneva, or *Gin*, among distillers, an ordinary malt spirit, distilled a second time, with the addition of some juniper berries.

Originally, the berries were added to the malt in the grinding; so that the spirit thus obtained was flavoured with the berries from the first, and exceeded all that could be made by any other method. At present, they leave out the berries entirely, and give their spirits a flavour by distilling them with a proper quantity of oil of turpentine; which though it nearly resembles the flavour of juniper berries, has none of their valuable virtues.

GENEVIEVE, fathers or religious of; the name of a congregation of regular canons of the order of St Augustine, established in France.

The congregation of St Genevieve is a reform of the Augustine canons. It was begun by St Charles Faure, in the abbey of St Vincent de Senlis, of which he was a member, in the year 1618.

In the year 1634, the abbey was made elective; and a general chapter, composed of the superiors of 15 houses who had now received the reform, chose F. Faure coadjutor of the abbey of St Genevieve, and general of the whole congregation. Such were its beginnings.

It has since increased very much, and it now consists of above a hundred monasteries; in some whereof the religious are employed in the administration of the parishes and hospitals: and in others, in the celebration of divine service, and the instruction of ecclesiastics in seminaries for the purpose.

The congregation takes its name from the abbey of St Genevieve, which is the chief of the order, and whose abbot is the general thereof. The abbey itself took its name from St Genevieve, the patroness of the city of Paris, who died in the year 512. Five years after her death, Clovis erected the church of St Genevieve, under the name and invocation of St Peter, where her relicks are still, or were till lately preserved, her shrine visited, and her image carried with great processions and ceremonies upon extraordinary occasions, as when some great favour is to be entreated of heaven.

GENGIS KHAN, the renowned sovereign of the Moguls, a barbarous and bloody conqueror. See Jenghiz Khan, and (*History* of the) Moguls.

GENIAL, an epithet given by the Pagans to certain gods who were supposed to preside over generation.

The genial gods, says Festus, were earth, air, fire, and water. The twelve signs, together with the sun and moon, were sometimes also ranked in the nnmber.

GENII, a sort of intermediate beings, by the Mahometans believed to exist, between men and angels. They are of a grosser fabric than the latter, but much more active and powerful than the former. Some of them are good, others bad, and they are capable of future salvation or damnation like men. The orientals pretend that these genii inhabited the world many thousand years before the creation of Adam, under the reigns of several princes, who all bore the common name of Solomon; that falling at length into an almost general corruption, Eblis was sent to drive them into a remote part of the earth, there to be confined; and that some of that generation still remaining were by Tahmurath, one of the ancient kings of Persia, forced to retreat into the famous mountain of *Kaf*; of whose successions and wars they have many fabulous and romantic stories. They also made several ranks and degrees among this kind of beings (if they are not rather

different

different species); some being absolutely called *Jin*; some *Peri*, or fairies: some *Div*, or giants; and others *Tacwins*, or fates.

GENIOGLOSSI, in *Anatomy*. See ANATOMY, *Table of the Muscles*.

GENIOHYOIDÆUS, in *Anatomy*. *Ibid*.

GENIOSTOMA, a genus of plants belonging to the pentandria class. See BOTANY *Index*.

GENIPPA, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY *Index*.

GENISTA, BROOM, or DYERS WEED, a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

GENITAL, an appellation given to whatever belongs to the parts of generation. See ANATOMY, N° 107, 108.

GENITES, among the Hebrews, those descended from Abraham, without any mixture of foreign blood.

The Greeks distinguished by the name of *genites* such of the Jews as were issued from parents, who, during the Babylonish captivity, had not allied with any gentile family.

GENITIVE, in *Grammar*, the second case of the declension of nouns. The relation of one thing considered as belonging in some manner to another, has occasioned a peculiar termination of nouns called the *genitive case*; but in the vulgar tongues they make use of a sign to express the relation of this case. In English they prefix the particle *of*, in French *de* or *du*, &c. Though in strictness there are no cases in either of these languages; insomuch as they do not express the different relations of things by different terminations, but by additional prepositions, which is otherwise in the Latin.

GENIUS, a good or evil spirit or dæmon, whom the ancients supposed set over each person, to direct his birth, accompany him in life, and to be his guard. See DÆMON.

Among the Romans, Festus observes, the name *genius* was given to the god who had the power of doing all things, *deum qui vim obtineret rerum omnium gerendarum*; which Vossius, *de Idol.* rather chooses to read *genendarum*, who has the power of producing all things; by reason Censorinus frequently uses *gerere* for *gignere*.

Accordingly St Augustin, *de Civitate Dei*, relates, from Varro, that the Genius was a god who had the power of generating all things; and presided over them when produced.

Festus adds, that Aufustius spake of the genius as the Son of God, and the Father of men, who gave them life; others, however, represented the genius as the peculiar or tutelary god of each place; and it is certain, the last is the most usual meaning of the word. The ancients had their *genii* of nations, of cities, of provinces, &c. Nothing is more common than the following inscription on medals, GENIUS POPULI ROM. "the genius of the Roman people;" or GENIO POP. ROM. "to the genius of the Roman people. In this sense *genius* and *lar* were the same thing; as, in effect, Censorinus and Apulius affirm they were. See LARES and PENATES.

The Platonists, and other eastern philosophers, supposed the *genii* to inhabit the vast region or extent of air between earth and heaven. They were a sort of intermediate powers, who did the office of mediators between gods and men. They were the interpreters and agents of the gods; communicated the wills of the deities to men; and the prayers and vows of men to the gods. As it was unbecoming the majesty of the gods to enter into such trifling concerns, this became the lot of the *genii*, whose nature was a mean between the two; who derived immortality from the one, and passions from the other; and who had a body framed of an aerial matter. Most of the philosophers, however, held, that the genii of particular men were born with them, and died; and Plutarch attributes the ceasing of oracles partly to the death of the genii.—See ORACLE.

The heathens, who considered the genii as the guardians of particular persons, believed that they rejoiced and were afflicted at all the good and ill fortune that befel their wards. They never, or very rarely, appeared to them; and then only in favour of some person of extraordinary virtue or dignity. They likewise held a great difference between the genii of different men; and that some were much more powerful than others: on which principle it was, that a wizzard in *Appian* bids Antony keep at a distance from Octavius, by reason Antony's genius was inferior to and stood in awe of that of Octavius. There were also evil genii, who took a pleasure in persecuting men, and bringing them evil tidings: such was that mentioned by Plutarch which appeared to Brutus the night before the battle of Philippi. These were also called *larvæ* and *lemures*. See LARVÆ and LEMURES.

GENIUS, in matters of literature, &c. a natural talent or disposition to do one thing more than another; or the aptitude a man has received from nature to perform well and easily that which others can do but indifferently and with a great deal of pains.

To know the bent of nature is the most important concern. Men come into the world with a genius determined not only to a certain art, but to certain parts of that art, in which alone they are capable of success. If they quit their sphere, they fall even below mediocrity in their profession. Art and industry add much to natural endowments, but cannot supply them where they are wanting. Every thing depends on genius. A painter often pleases without observing rules; whilst another displeases though he observes them, because he has not the happiness of being born with a genius for painting.

A man born with a genius for commanding an army, and capable of becoming a great general by the help of experience, is one whose organical conformation is such, that his valour is no obstruction to his presence of mind, and his presence of mind makes no abatement of his valour. Such a disposition of mind cannot be acquired by art: it can be possessed only by a person who has brought it with him into the world. What has been said of these two arts may be equally applied to all other professions. The administration of great concerns, the art of putting people to those employments for which they are naturally formed, the study of physic, and even gaming itself, all require a genius. Nature has thought fit to make a distribution of her talents

Genius, Genoa. talents among men, in order to render them necessary to one another; the wants of men being the very first link of society: she has therefore pitched upon particular persons, to give them aptitude to perform rightly some things which she has rendered impossible to others; and the latter have a greater facility granted them for other things, which facility has been refused to the former. Nature indeed has made an unequal distribution of her blessings among her children; yet she has disinherited none; and a man divested of all kinds of abilities, is as great a phenomenon as an universal genius.

From the diversity of genius the difference of inclination arises in men, whom nature has had the precaution of leading to the employments for which she designs them, with more or less impetuosity in proportion to the greater or lesser number of obstacles they have to surmount in order to render themselves capable of answering this vocation. Thus the inclinations of men are so very different, because they follow the same mover, that is, the impulse of their genius. This, as with the painter, is what renders one poet pleasing, even when he trespasses against rules; while others are disagreeable, notwithstanding their strict regularity.

The genius of these arts, according to the abbé du Bos, consists in a happy arrangement of the organs of the brain; in a just conformation of each of these organs; as also in the quality of the blood, which disposes it to ferment, during exercise, so as to furnish plenty of spirits to the springs employed in the functions of the imagination. Here he imagines that the composer's blood is heated; for that painters and poets cannot invent in cool blood; nay, that it is evident they must be rapt into a kind of enthusiasm when they produce their ideas. Aristotle mentions a poet who never wrote so well as when his poetic fury hurried him into a kind of frenzy. The admirable pictures we have in Tasso of Armida and Clorinda were drawn at the expence of a disposition he had to real madness, into which he fell before he died. "Do you imagine, (says Cicero), that Pacuvius wrote in cold blood? No, it was impossible. He must have been inspired with a kind of fury, to be able to write such admirable verses."

GENOA, a city of Italy, and formerly capital of a republic of the same name, situated in E. Long. 8. 36. N. Lat. 44. 25.—By the Latin authors it is very frequently, though corruptly called *Janua*; and its present territories made part of the ancient Liguria. The era of its foundation is not known. In the time of the second Punic war it was a celebrated emporium; and having declared for the Romans, was plundered and burnt by Mago the Carthaginian. It was afterwards rebuilt by the Romans; and with the rest of Italy continued under their dominion till the decline of the western empire in 476. Soon after, it fell under the power of Theodoric the Ostrogoth; who having defeated the usurper Odoacer, became king of Italy. This happened in the year 498; and in a short time, the Goths being almost entirely subdued by Belisarius the emperor Justinian's general, Genoa was reannexed to the Roman empire. In 638, it was plundered and burnt by the Lombards, whose king Protharis erected it into a provincial dukedom.

Genoa. The Lombards continued masters of Genoa till the year 774, when they were conquered by Charles the Great, son to Pepin king of France. He reduced Liguria to the ancient bounds settled by Augustus, and erected it into a marquisate: appointing his relation *Audemarus* the first count or margrave. Genoa at this time being distinguished for its wealth and populousness, began to give its name to the whole coast; and continued under the dominion of these counts for about 100 years, till the race of the Pepins became entirely extinct in Italy, and the empire was transferred to the German princes.—In the year 935 or 936, while the Genoese forces were absent on some expedition, the Saracens surprised the city, which they plundered and burnt, putting to death a great number of the inhabitants, and carrying others into captivity. Having embarked their captives, together with an immense booty, they set sail for Africa; but the Genoese immediately returning, pursued the invaders; and having entirely defeated them, recovered all the captives and booty, and took a great many of the enemy's ships.

About the year 950, the Franks having lost all authority in Italy, the Genoese began to form themselves into a republic, and to be governed by their own magistrates, who were freely elected, and took the name of *Consuls*. In order to support their independence, they applied themselves with great assiduity to commerce and navigation; and being apprehensive that some of the German emperors, who frequently entered Italy as invaders, might renew their pretensions to their state, they consented to acknowledge Berengarius III. duke of Friuli, who had been elected emperor by a party of Italian nobles. Berengarius, who had much ado to maintain himself in his new dignity, endeavoured by his concessions to enlarge the number of his friends and adherents; and accordingly made no difficulty to confirm the new republic in all its rights and privileges. After this the Genoese began to extend their commerce from Spain to Syria, and from Egypt to Constantinople: their vessels, according to the custom of these times, being fitted for fighting as well as merchandise. Having thus acquired great reputation, they were invited in 1017, by the Pisans, who had likewise formed themselves into a republic, to join with them in an expedition against Sardinia, which had been conquered by the Moors. In this expedition they were successful; the island was reduced; but from this time an enmity commenced between the two republics, which did not end but with the ruin of the Pisans.

The first war with Pisa commenced about 30 years after the Sardinian expedition, and lasted 18 years; when the two contending parties having concluded a treaty of peace, jointly sent their forces against the Moors in Africa, of whom they are said to have killed 100,000. The Genoese were very active in the time of the crusades, and had a principal share in the taking of Jerusalem. They also waged considerable wars with the Moors in Spain, of whom they generally got the better. They also prevailed against the neighbouring states; and, in 1220, had enlarged their territories beyond the skirts of the Apennines, so that the rest of Italy looked upon them with a jealous eye; but in 1311 the factions which had for a long time reigned in the city, notwithstanding all its wealth and power, induced

Genoa. induced the inhabitants so submit themselves for 20 years to the dominion of Henry VII. emperor of Germany. That emperor, however, died in August 1312; and the vicar he had left soon after went to Pisa, upon which the dissensions in Genoa revived with greater fury than ever. In 1317, a quarrel happened between the families of Spinola and Doria; which came to such a height, that both parties fought in the streets for 24 days without intermission, raised battering engines against each other's houses, and filled the city with blood. At last the Spinolæ quitted the city, and retired to their territories in the Apennine mountains. The civil war continued till the year 1331; when, by the mediation of the king of Naples, it was concluded, that all exiles should return to the city; that the republic should be governed by the king's vicar; and all the offices of the state be equally divided between the Guelfs and the Gibellines, the two contending parties.

By this ruinous war, the coast of Genoa, formerly adorned with palaces and vineyards, was now reduced to the appearance of a barren waste. So great was the general desolation, that according to Petrarch, the spectators who sailed along were struck with astonishment and horror. Villani, a cotemporary author, relates, that it was supposed by the learned, that greater exploits had not been performed at the siege of Troy; and that the losses each party had sustained would have been sufficient to have purchased a kingdom, the Genoese republic being in his time the richest and most powerful state in Christendom. The annalist Stella informs us, that, before the war, the most extravagant profusion and luxury prevailed among the Genoese: but that, towards the end, many noble families were reduced to indigence and poverty; so that about 100 years after, it became fashionable for the nobles to live in a plain manner, without any show or magnificence.

In 1336, both parties, suspending their mutual animosities, sent two fleets of 20 galleys each into the German ocean, to the assistance of the king of France, who was engaged in a war with Edward III. king of England. This naval expedition proved the cause of a most remarkable revolution in the Genoese government. The sailors of the fleet, thinking themselves injured by their officers, whom they accused of defrauding them of their pay, proceeded to an open mutiny; and having expelled the admiral, and other commanders, seized the galleys. The king of France being chosen arbitrator, decided in favour of the officers, and imprisoned 16 of the chiefs of the mutineers. Upon this several of the sailors left the fleet, and returned to Genoa; where they went round the coasts, repeating their mutinous complaints, which were greatly hearkened to, upon a false report that the mutineers who had been imprisoned were broke upon the wheel. The factious spirit increased: and at last the Genoese insisted in a tumultuous manner for having an abbot of their own choosing, and 20 of the people with the consent of the captains of the republic assembled for that purpose. While the mob were impatiently expecting their decision, a mechanic, generally accounted a fool, mounted a wooden bench, and called out that one Simon Bucanigree should be chosen abbot. This being instantly echoed by the populace, he was first declared *abbot*, then *lord*, and at last *duke* of Genoa.

This new expedient did not at all answer the purpose. The dissensions continued as violent as ever, nothwithstanding the power of the new magistrates; and by these perpetual divisions the republic was at last so much weakened, that in 1390 the king of France was declared lord of Genoa. Under the French government, however, they soon became exceedingly impatient; and, in 1422, the duke of Milan obtained the sovereignty. With this situation they were equally displeased, and therefore revolted in 1436. Twenty-two years after, finding themselves pressed by a powerful fleet and army sent by Alphonso king of Naples, they again conferred the sovereignty of their state, upon the king of France. In 1460, they revolted from the French; and, four years after, put themselves again under the protection of the duke of Milan: from whom they revolted in 1478. He was again declared sovereign of the republic in 1488; and, 11 years after, the city and territories of Genoa were conquered by Louis XII. of France.

The almost unparalleled fickleness of the Genoese disposition was not to be corrected by this misfortune. They revolted in 1506; but next year were again subdued by Louis. Six years after, they again revolted: and in 1516, the city was taken and plundered by the Spaniards. In 1528, Andrew Doria, a Genoese admiral in the service of the French, undertook to rescue his country from the dominion of foreign princes, and restore it to its liberty. Knowing well the fickle disposition of his countrymen, he took all occasions of exciting discontents among them against the government. He persuaded them, that the French (who had again obtained the sovereignty) had left them only a shadow of liberty, while they pretended to protect them from their enemies. To the nobility he represented the disgrace of suffering the government to be vested in the hands of foreigners less worthy of authority than themselves. Thus he soon formed a strong faction, and formed his plan; for the execution of which he took the most proper time, namely, when almost three-fourths of the French garrison had been carried off by the plague. He advanced with 500 men; and his friends having opened the gates of the city to him, he seized the principal posts, and thus became master of it without drawing his sword. The garrison retired to the forts, where they soon after capitulated, and being driven out of the city, Doria re-established the ancient form of government. See Doria.

The republic hath since continued to preserve her liberty, though greatly fallen from her ancient splendour, and now become a very inconsiderable state. In 1684, the Genoese had the misfortune to fall under the resentment of Louis XIV. at which time the city was almost destroyed by a formidable bombardment. In the year 1688, it was bombarded by Admiral Byng, and forced to capitulate; but there were at that time no vews of making a permanent conquest of the city. In 1730, the island of Corsica revolted from the Genoese, and could never afterwards be reduced by them; for which reason it was sold to the French, who in the year 1770 totally reduced it.

The

Genoa. The Genoese territories extend along that part of the Mediterranean sea, commonly called the *Gulf of Genoa*, about 152 miles; but their breadth is very unequal, being from eight to about 20 miles. Where they are not bounded by the sea, the following states and countries, taking them from west to east, are their boundaries, viz. Piedmont, Montferrat, Milan, Placentia, Parma, the dukedom of Tuscany, and the republic of Lucca. This tract, though a great part of it is mountainous, and some of that barren enough, yet produces plenty of excellent fruit, good pasture, wood, garden stuff, and mulberry trees, with some wine and oil, but little corn. What they want of the last, they have either from Lombardy, Sicily, or Naples.

Genoa stands on the coast of the Mediterranean sea, at the bottom of a little gulf, partly on the flat, and partly on the declivity, of a pleasant hill; in consequence of which, it appears to great advantage from the sea. It is defended on the land side by a double wall, which in circumference is about ten Italian miles. Two of the streets consist entirely of a double straight row of magnificent palaces. The others, though clean and well paved, are crooked and narrow. The palaces of the nobility are almost all of marble, and many of them are painted on the outside. That there should be such a profusion of marble here, is not to be wondered at, as the neighbouring hills abound with it. The city contains a vast number of palaces, churches, and convents, and several hospitals. The palace where the doge resides, and where the great and little council, and the two colleges of the procuratori and governatori assemble, is a large stone building in the centre of the city. It contains some fine paintings in fresco; two statues of Andrew and John Doria in white marble; and an arsenal, in which are said to be arms for thirty-four thousand men, with a shield, containing one hundred and twenty pistol barrels, and thirty-three coats of mail, which, it is pretended, were worn by as many Genoese heroines in a croisade. Of the churches, the finest are those of the Annunciation, St Mary Carignan, St Dominic, and St Martha. In the cathedral is a dish made of a single emerald. All the inhabitants here, except the principal ladies, who are carried in chairs, walk on foot, on account of the narrowness or steepness of the streets. The fortifications of the city, towards the sea, are remarkably strong. There are two fine stone bridges over the rivers Bonzerva and Bisagno, the first whereof washes the west, and the other the east side of the city, within which there is also a surprising stone bridge joining two hills. The harbour, though large, is far from being safe; but no care or expence has been spared to render it as safe and commodious as possible. The wind to which it is most exposed, is that called *Labeccio*, or the south-west. The place where the republic's galleys lie, is called the Darsena, where are a great number of Turkish slaves. On a rock, on the west side of the harbour, is the fanal or lighthouse, a high tower on the top of which is a lanthorn, containing thirty-six lamps. The population of Genoa is estimated at 150,000, and the trade is chiefly in velvets, damasks, plush, and other silks, brocades, lace, gloves, sweetmeats, fruits, oil, Parmesan cheese, anchovies, and medicinal drugs from the Levant; but the badness of the harbour, and the high price of commodities, greatly checks the commerce. In 1751, Genoa was declared a free port for ten years, under certain restrictions: in that called *Porto Franco*, any merchant may have a warehouse, and import or export goods duty free; but such as are disposed of in the city, or on the continent, are taxed pretty high. The nobility are allowed to trade in the wholesale way; to carry on velvet, silk, and cloth manufactures; and to have shares in merchant ships: and some of them, as the Palavicini, are actually the greatest merchants in Genoa. Another very profitable article of trade carried on by them is banking, and dealing in bills of exchange. A new academy of painting, sculpture, civil and military architecture, was instituted here in 1751. One may walk the streets of Genoa in the night with the greatest safety, which is more than can be said of many cities in Italy. Excessive splendour and luxury are, in several respects, restrained by salutary laws. No beggars are permitted to ask alms in Genoa, and the inns are better than those at Turin. When a single person is buried, a kind of garland of all sorts of artificial flowers is placed on the coffin. The Genoese in general are esteemed crafty, industrious, and inured to hard labour above the other Italians.

Amidst the political convulsions which agitated Europe, in consequence of the unexampled French revolution, it was scarcely to be expected that Genoa would escape the shock. Accordingly in the year 1798, by the force and intrigues of the French republicans, its political constitution was totally subverted, and changed into what was afterwards denominated the *Ligurian Republic*, which was to be governed in a manner similar to that of their own, and the country also was divided into departments. As the preceding campaign had terminated in favour of the combined powers, and left them in the possession of every important place in Italy, this only excepted, the capture of it became an object of the utmost consequence to the contending parties. To regain it was the highest ambition of the house of Austria, while the retaining of it was matter of solicitude to the French republic. The reason is obvious. The conquest of it restored to the emperor of Germany the possession of all Italy, gave him the means of resuming his former positions in the Maritime Alps, and reinforcing his former position on the Rhine. To the French it was a place of the utmost consequence, because while they were enabled to retain it in their own hands, they could easily favour the operations of their army in Switzerland, or their entrance into Italy by the defiles of Piedmont.

As the allies were fully determined on its conquest for the reasons already assigned, as well as for others of an inferior nature and magnitude, it is but candid to admit that the general by whom it was defended had innumerable difficulties to struggle with, and obstacles to surmount. When Massena succeeded Championet, the army was reduced to the most melancholy situation. Confined during the winter season to the bleak summits of the Apennines, it was reduced in numbers more than one half, and a constant prey to famine and disease. To add to the difficulties which everywhere presented themselves to Massena, the higher classes of the Genoese looked upon the French only as the destroyers of their rank, commerce, and political importance; in consequence of which they secretly aided every measure by which they might be driven from the country. Instead of of 60,000 men which he was promised, Massena had no more than 20,000 after all his unwearied exertions, and with these he had to defend an extent of country from Mount Cenis to the frontiers of Tuscany. He wisely dismissed all the former generals, independent of their merit, because the soldiers associated with them the idea of former misery and disgrace. In addition to the superior strength of the Austrian army, Massena found a formidable insurrection raised against him in the eastern territory of the Genoese republic. The passage by sea was obstructed by the British fleet, and his expected succours from Marseilles only reached him in part. As he could not meet the army in the field by which he was blockaded, his only alternative was to remain in Genoa, every moment in dread of perishing by famine, if not speedily relieved. After enduring great hardships, humanity for the starving inhabitants induced him to surrender.

The victory of Marengo however restored it again to the French; and after being indulged with a nominal independence for some time, it was incorporated with France in 1805. When Bonaparte sustained his great reverses in 1814, Genoa surrendered to a British force, under a promise of independence, which promise was however broken, and the city with its territory was annexed to Sardinia. When the insurrection took place in this kingdom in March 1821, Genoa gladly seized the opportunity to throw off the foreign yoke. But the failure of the revolution in Piedmont led to the suppression of the independence of Genoa.

GENSING. See PANAX, BOTANY *Index*.

GENTIANA, GENTIAN, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 20th order, *Rotaceæ*. See BOTANY *Index*.

GENTILE, in matters of religion, a Pagan, or worshipper of false gods.

The origin of this word is deduced from the Jews, who called all those who were not of their name גוים *gojim*, i. e. *gentes*, which in the Greek translations of the Old Testament is rendered τα εθνα; in which sense it frequently occurs in the New Testament; as in Matth. vi. 32. "All these things the nations or Gentiles seek." Whence the Latin church also used *gentes* in the same sense as our *Gentiles*, especially in the New Testament. But the word *gentes* soon got another signification, and no longer meant all such as were not Jews; but those only who were neither Jews nor Christians, but followed the superstitions of the Greeks and Romans, &c. In this sense it continued among the Christian writers, till their manner of speech, together with their religion, was publicly and by authority received in the empire; when *gentiles*, from *gentes*, came into use: and then both words had two significations, viz. in treatises or laws concerning religion, they signified Pagans, neither Jews nor Christians; and in civil affairs, they were used for all such as were not Romans.

GENTILE, in the Roman law and history, a name which sometimes expresses what the Romans otherwise called *barbarians*, whether they were allies of Rome or not: but this word was used in a more particular sense for all strangers and foreigners not subject to the Roman empire.

GENTILESCHI, HORATIO, an Italian painter, was born at Pisa in 1563. After having made himself famous at Florence, Rome, Genoa, and other parts of Italy, he removed to Savoy; from whence he went to France, and at last, upon the invitation of Charles I. came over to England. He was well received by that king, who appointed him lodgings in his court, together with a considerable salary; and employed him in his palace at Greenwich, and other public places. The most remarkable of his performances in England, were the ceilings of Greenwich, and York house. He did also a Madona, a Magdalen, and Lot with his two daughters, for King Charles; all which he performed admirably well. After the death of the king, when his collection was exposed to sale, nine pictures of Gentileschi were sold for 600l. and are now said to be the ornaments of the hall in Marlborough house. His most esteemed piece abroad was the portico of Cardinal Bentivoglio's palace at Rome. He made several attempts in face painting, but with little success; his talent lying altogether in histories, with figures as big as the life. He was much in favour with the duke of Buckingham, and many others of the nobility. After 12 years continuance in England, he died here at 84 years of age, and was buried in the queen's chapel at Somerset-house. His print is among the heads of Vandyke, he having been drawn by that great master. He left behind him a daughter, *Artemisia Gentileschi*, who was but little inferior to her father in history painting, and excelled him in portraits.

GENTILIS, ALBERICUS, professor of civil law at Oxford; an Italian by birth. He had quitted Italy with his father, on account of religion. He wrote several works; three books, in particular, *De jure belli*, which have not been unserviceable to Grotius. He died at London in 1608.

GENTILIS, *Scipio*, brother to the former, and as celebrated a civilian as he, forsook his native country that he might openly profess the Protestant religion. He was counsellor of the city of Nuremberg, and professor of law with uncommon reputation. He was a great humanist; and in his lectures, as well as books, mixed the flowers of polite learning with the thorns of the law. He died in 1616.

GENTLEMAN. Under this denomination are comprehended all above the rank of yeomen *, whereby noblemen are truly called *gentlemen*.

* See Commonalty.

A gentleman is usually defined to be one, who, without any title, bears a coat of arms, or whose ancestors have been freemen: and by the coat that a gentleman giveth, he is known to be, or not to be, descended from those of his name that lived many hundred years since.

The word is formed of the French *gentilhomme*; or rather of *gentil*, "fine, fashionable, or becoming;" and the Saxon *man*, q. d. *honestus*, or *honesto loco natus*.—The same signification has the Italian *gentilhuomo*, and the Spanish *hidalgo*, or *hijo dalgo*, that is, the son of somebody, or a person of note.—If we go farther back, we shall find *gentleman* originally derived from the Latin *gentilis homo*; which was used among the Romans for a race of noble persons of the same name, born of free or ingenuous parents, and whose ancestors had never been slaves or put to death by law. Thus Cicero in his *Topics*, "*Gentiles sunt, qui inter se eodem sunt nomine, ab ingenuis oriundi, quorum majorum nemo servitutem servivit, qui capite non sunt diminuti*," Gentleman, Gentoos. nuti," &c.—Some hold that it was formed from *gentile*, i. e. pagan; and that the ancient Franks, who conquered Gaul, which was then converted to Christianity, were called *gentiles* by the natives, as being yet heathens.—Others relate, that towards the declension of the Roman empire, as recorded by Ammianus Marcellinus, there were two companies of brave soldiers, the one called *gentiles*, and the other *scutarii*; and that it was hence we derive the names *gentleman* and *esquire*. See ESQUIRE.—This sentiment is confirmed by Pasquire, who supposes the appellation *gentiles* and *ecuyers* to have been transmitted to us from the Roman soldiery; it being to the *gentiles* and *scutarii*, who were the bravest of the soldiery, that the principal benefices and portions of land were assigned. See BENEFICE.—The Gauls observing, that during the empire of the Romans, the *scutarii* and *gentiles* had the best tenements or appointments of all the soldiers on the frontiers of the provinces, became insensibly accustomed to apply the same names, *gentilhommes* and *ecuyers*, to such as they found their kings gave the best provisions or appointments to.

GENTLEMAN *Usher of the Black Rod*. See ROD.

GENTLEMEN *of the Chapel*; officers whose duty and attendance is in the royal chapel, being in number 32. Twelve of them are priests; the other 20, commonly called *clerks of the chapel*, assist in the performance of divine service. One of the first 12 is chosen for confessor of the household; whose office is to read prayers every morning to the household servants, to visit the sick, examine and prepare communicants, and administer the sacrament. One of 20 clerks, well versed in music, is chosen first organist, who is master of the children, to instruct them in music, and whatever else is necessary for the service of the chapel; a second is likewise an organist; a third, a lutanist; and a fourth a violist. There are likewise three vergers, so called from the silver rods they carry in their hands; being a serjeant, a yeoman, and groom of the vestry; the first attends the dean and subdean, and finds surplices and other necessaries for the chapel; the second has the whole care of the chapel, keeps the pews, and seats of the nobility and gentry; the groom has his attendance within the chapel door, and looks after it.

GENTOOS, in modern history, according to the common acceptation of the term, denote the professors of the religion of the bramins or brachmans, who inhabit the country called *Hindostan*, in the East Indies, from the word *stan*, a "region," and *hind* or *hindoo*; which Ferishtah, as we learn from Colonel Dow's translation of his history, supposes to have been a son of Ham the son of Noah. It is observed, however, that Hindoo is not the name by which the inhabitants originally styled themselves; but according to the idiom of the *Shanscrit* which they use, *jumbodeep* from *jumboo*, a "jackall," an animal common in their country; and *deep*, a large portion of land surrounded by the sea; or *bhertekhunt*, from *khunt*, i. e. "a continent," and *bherrhut*, the name of one of the first Indian rajahs. It is also to be observed, that they have assumed the name of *Hindoos* only since the era of the Tartar government, to distinguish themselves from their conquerors the Mussulmans. The term *Gentoo* or *Gent*, in the Shanscrit dialect, denotes *animal* in general, and in its more confined sense *mankind*, and is never appropriated particularly to such as follow the doctrines of Brama. These are divided into four great tribes, each of which has its own separate appellation; but they have no common or collective term that comprehends the whole nation under the idea affixed by the Europeans to the word *Gentoo*. Mr Halhed, in the preface to his translation of the Code of Gentoo Laws, conjectures that the Portuguese, on their first arrival in India, hearing the word frequently in the mouths of the natives, as applied to mankind in general, might adopt it for the domestic appellation of the Indians themselves, or perhaps their bigotry might force from the word *Gentoo* a fanciful allusion to gentile or Pagan. The Hindoos, or Gentoos, vie with the Chinese as to the antiquity of their nation. They reckon the duration of the world by four jogues, or distinct ages; the first the Suttee jogue, or age of purity, which is said to have lasted about 3,200,000 years; during which the life of man was 100,000 years, and his stature 21 cubits: the second, the Tirtah jogue, or the age in which one-third of mankind were reprobate; which consisted of 2,400,000 years, when men lived to the age of 10,000 years: the third, the Dwaper jogue, in which half of the human race became depraved, which endured to 600,000 years, when men's lives were reduced to 1000 years: and fourthly, the Collee jogue, in which all mankind were corrupted, or rather diminished, which the word *collee* imports. This is the present era, which they suppose will subsist for 400,000 years, of which near 5000 are already past; and man's life in this period is limited to 100 years. It is supposed by many authors, that most of the Gentoo *shasters*, or scriptures, were composed about the beginning of the Collee jogue: but an objection occurs against this supposition, viz. that the shasters take no notice of the deluge; to which the bramins reply, that all their scriptures were written before the time of Noah, and the deluge never extended to Hindostan. Nevertheless, it appears from the shasters themselves, that they claim a much higher antiquity than this; instances of which are recited by Mr Halhed.

The doctrine of transmigration is one of the distinguishing tenets of the Gentoos. With regard to this subject, it is their opinion, according to Mr Holwell, that those souls which have attained to a certain degree of purity, either by the innocence of their manners or the severity of their mortifications, are removed to regions of happiness proportioned to their respective merits: but that those who cannot so far surmount the prevalence of bad example, and the powerful degeneracy of the times, as to deserve such a promotion, are condemned to undergo continual punishment in the animation of successive animal forms, until, at the stated period, another renovation of the four jogues shall commence, upon the dissolution of the present. They imagine six different spheres above this earth; the highest of which, called *suttee*, is the residence of Brama, and his particular favourites. This sphere is also the habitation of those men who never uttered a falsehood, and of those women who have voluntarily burned themselves with their husbands; the propriety of which practice is expressly enjoined in the code of the Gentoo laws. This code, printed by the East India Company in 1776, is a very curious collection of Hindoo

Gentoos, Genuflexion.

doo jurisprudence, which was selected by the most experienced pundits or lawyers from curious originals in the Shanscrit language, who were employed for this purpose from May 1773 to February 1775; afterwards translated into the Persian idiom, and then into the English language by Mr Halhed.

The several institutes contained in this collection are interwoven with the religion of the Gentoos, and revered as of the highest authority. The curious reader will discover an astonishing similarity between the institutes of this code and many of the ordinances of the Jewish law: between the character of the bramins or priests, and the Levites; and between the ceremony of the scape goat under the Mosaic dispensation, and a Gentoo ceremony called the *ashummed jug*, in which a horse answers the purpose of the goat. Many obsolete customs and usages alluded to in many parts of the Old Testament, may also receive illustrations from the institutes of this code. It appears from the code, that the bramins, who are the priests and legislators of the country, have resigned all the secular and executive power into the hands of another cast or tribe; and no bramin has been properly capable of the magistracy since the time of the suttee jogue. The only privilege of importance which they have appropriated to themselves, is an exemption from all capital punishment: they may be degraded, branded, imprisoned for life, or sent into perpetual exile; but it is everywhere expressly ordained, that a bramin shall not be put to death on any account whatsover.

We have already observed, that the Hindoos are divided into four great and original tribes, which according to the Gentoo theology proceeded from the four different members of Brama, the supposed immediate agent of the creation under the spirit of the Almighty. These tribes are the Bramins, which proceeded from his mouth, and whose office is to pray, read, and instruct; the Chehteree, which proceed from his arms, whose office is to draw the bow, to fight, and to govern; the Bice, proceeding from the belly or thighs, who are to provide the necessaries of life by agriculture and traffic; and the Soonder, from the feet, which are ordained to labour, serve, and travel.

Few Christians, says the translator of the Gentoo code, have expressed themselves with a more becoming reverence of the grand and impartial designs of Providence, in all his works, or with a more extensive charity towards all their fellow creatures of every profession, than the Gentoos. It is indeed an article of faith among the Bramins, that God's all merciful power would not have permitted such a number of different religions, if he had not found a pleasure in beholding their varieties.

GENUFLEXION, (of *genu*, "knee," and *flecto*, "I bend,") the act of bowing or bending the knee; or rather of kneeling down.

The Jesuit Rosweyd, in his Onomasticon, shows, that genufluxion, or kneeling, has been a very ancient custom in the church, and even under the Old Testament dispensation; and that this practice was observed throughout all the year, excepting on Sundays, and during the time from Easter to Whitsuntide, when kneeling was forbidden by the council of Nice.

Others have shown, that the custom of not kneeling on Sunday had obtained from the time of the apostles, as appears from St Irenæus, and Tertullian; and the Ethiopic church, scrupulously attached to the ancient ceremonies, still retain that of not kneeling at divine service. The Russians esteem it an indecent posture to worship God on the knees. Add, that the Jews usually prayed standing. Rosweyd gives the reasons of the prohibition of genuflexion on Sundays, &c. from St Basil, Anastasius, St Justin, &c.

Baronius is of opinion, that genuflexion was not established in the year of Christ 58, from that passage in Acts xx. 36. where St Paul is expressly mentioned to kneel down at prayer; but Saurin shows, that nothing can be thence concluded. The same author remarks, also, that the primitive Christians carried the practice of genuflexion so far, that some of them had worn cavities in the floor where they prayed: and St Jerome relates of St James, that he had contracted a hardness on his knees equal to that of camels.

GENUS, among metaphysicians and logicians, denotes a number of beings which agree in certain general properties common to them all: so that a genus is nothing else but an abstract idea, expressed by some general name or term. See LOGIC and METAPHYSICS.

GENUS, is also used for a character or manner applicable to every thing of a certain nature or condition: in which sense it serves to make capital divisions in divers sciences, as medicine, natural history, &c.

GENUS, in *Rhetoric*. Authors distinguish the art of rhetoric, as also orations or discourses produced thereby, into three genera or kinds, demonstrative, deliberative, and judiciary. To the demonstrative kind belong panegyrics, genethliacons, epithalamiums, funeral harangues, &c. To the deliberative belong persuasions, dissuasions, commendations, &c. To the judiciary kind belong defences and accusations.

GENUS, in *Medicine*. See MEDICINE, under the *Nosology*.

GENUS, in *Natural History*, a subdivision of any class or order of natural beings, whether of the animal, vegetable, or mineral kingdoms, which agree in certain common characters. See *NATURAL History*.

GENUS, in *Music*, by the ancients called *genus melodiæ*, is a certain manner of dividing and subdividing the principles of melody; that is, the consonant and dissonant intervals, into their concinuous parts.

The moderns considering the octave as the most perfect of intervals, and that whereon all the concords depend, in the present theory of music, the division of that interval is considered as containing the true division of the whole scale.

But the ancients went to work somewhat differently: the diatessaron, or fourth, was the least interval which they admitted as concord; and therefore they sought first how that might be most conveniently divided; from whence they constituted the diapente and diapason.

The diatessaron being thus, as it were, the root and foundation of the scale, what they called the *genera*, or kinds, arose from its various divisions; and hence they defined the *genus modulandi* to be the manner of dividing the tetrachord and disposing its four sounds as to succession.

The genera of music were three, the enharmonic, chromatic, and diatonic. The two first were variously subdivided;

subdivided; and even the last, though that is commonly reckoned to be without any species, yet different authors have proposed different divisions under that name, without giving any particular names to the species as was done to the other two.

For the characters, &c. of these several genera, see ENHARMONIC, CHROMATIC, and DIATONIC.

GEOCENTRIC, in *Astronomy*, is applied to a planet, or its orbit, to denote it concentric with the earth, or as having the earth for its centre, or the same centre with the earth.

GEOFFRÆA, a genus of plants belonging to the diadelphia class, and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY and MATERIA MEDICA *Index*.

GEOFFREY of MONMOUTH, bishop of St Asaph, called by our ancient biographers *Gallofridus Monumentensis*. Leland conjectures that he was educated in a Benedictine convent at Monmouth, where he was born; and that he became a monk of that order. Bale, and after him Pits, call him archdeacon of Monmouth; and it is generally asserted that he was made bishop of St Asaph in the year 1151 or 1152, in the reign of King Stephen. His history was probably finished after the year 1138. It contains a fabulous account of British kings, from the Trojan Brutus to the reign of Cadwallader in the year 690. But Geoffrey, whatever censure he may deserve for his credulity, was not the inventor of the stories he relates. It is a translation from a manuscript written in the British language, and brought to England from Armorica by his friend Gualter, archdeacon of Oxford. But the achievements of King Arthur, Merlin's prophecies, many speeches and letters, were chiefly his own addition. In excuse for this historian, Mr Wharton judiciously observes, that fabulous histories were then the fashion, and popular traditions a recommendation to his book.

Geoffroy.

GEOFFROY, STEPHEN-FRANCIS, a physician eminent for his chemical and botanical knowledge, was born at Paris in the year 1672, where his father kept an apothecary's shop, and had been several times in the magistracy. He received a liberal education; and, while prosecuting the study of medicine, he had conferences at his father's house with Cassini, du Verney, Homberg, and other men of distinguished eminence. At Montpellier he attended the lectures of the most able professors of physic, and afterwards visited the south of France, carefully viewing every object deserving of his attention. He accompanied count de Tallard to England in 1698, where he became acquainted with the chief men of science, and was made a member of the Royal Society. He next went into Holland, and in 1700 he attended the abbé de Louvois in a tour to Italy. He was, on his return, made bachelor of medicine in 1702, and, in two years after, he was created M. D. One of his theses was on the question, "*An hominis primordia vermis?*" which was translated into French for the sake of some ladies of exalted rank, by whom it was deemed interesting.

Geoffroy, Geographical.

Geoffroy did not hastily commence the practice of medicine, continuing the prosecution of his studies in retirement for some years. He never appeared anxious to push himself forward, although his knowledge made him be often consulted by several gentlemen of the faculty. He was so concerned for the recovery of his patients, that it gave him an air of melancholy, which at first alarmed them, till they became acquainted with the cause. He was, in 1709, made professor of physic by the king to the Royal College, vacant by the death of the celebrated Tournefort. He began with lectures on materia medica; and in 1712, M. Fagon resigned to him the chemical chair: on both which topics Geoffroy lectured with unwearied assiduity. He was twice chosen to the office of dean by the faculty of Paris, and he filled a place in the Royal Academy of Sciences, from the year 1699. His health at last yielded to his toils, and he died in January, 1731. He is known to the chemical world by his table of affinities, far superior to any which had appeared before his time. His greatest work was his History of the Materia Medica, which, in an unfinished state, was published after his death in the year 1741, in 3 vols. 8vo.

GEOGRAPHICAL MILE, the same with the sea mile; being one minute, or the 60th part of a degree of a great circle on the earth's surface.

GEOGRAPHY.

INTRODUCTION.

Definition.

GEOGRAPHY is that part of knowledge which describes the surface of the earth; its divisions, extent, and boundaries; the relative position of the several countries and places on the globe, and the manners, customs, and political relations of their inhabitants. The word is Greek, γεωγραφια from γῆ or γεα, *terra*, "the earth," and γραφω, *scribo*, "I write." As every thing that immediately contributes to the ascertaining of the situation and limits of countries and places on the surface of the earth, is within the province of geography, this science includes the description and use of globes, maps, and charts, with the methods of constructing them.

2 Division of geography.

This science has been divided into GEOGRAPHY properly so called, or a description of the *lands* of the globe, and HYDROGRAPHY, or a description of the waters; but this division is of little consequence, and is now seldom employed. Geography has also been divided into *general* and *particular*, terms which are variously understood by different writers on the subject. By Varenius, one of the oldest and best modern writers on general geography, general or universal geography is used to denote that part of the subject which considers the earth in general, and explains its affections as a terrestrial globe, without attending to its arbitrary division into different regions; and by particular or special geography, this writer understands the description of the particular regions of the earth: and he divides this latter into two parts; *chorography*, describing some considerable

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siderable parts of the earth, as of the quarters, and *topography*, describing a particular province or district.

Geography may be conveniently divided into *descriptive* geography, or that part of the science which describes the form, limits, extent, and variety of surface of different countries, with the manners and customs of their inhabitants; and *physical* geography, or that part which teaches how to determine the situations of different places in the globe, and to lay down and delineate their positions for the information of others. Descriptive geography is the more popular and entertaining part of the subject. It is usually divided into ancient or classical geography, geography of the middle ages, and modern geography. The first branch of the subject considers the state of the earth so far as it was known or discovered at different periods, previous to the sixth century of the Christian era. The geography of the middle ages extends from the sixth to the fifteenth century, and modern geography from the fifteenth century to the present time. One of the most useful subdivisions of descriptive geography is that employed by Mr Pinkerton, who considers the geography of the several countries which he describes under four different heads. 1. *Historical* or *progressive geography;* in which he treats of the names, extent, original population, progressive geographical improvements, historical epochs and antiquities of the countries. 2. *Political geography;* under which he describes the religion and ecclesiastic institutions, government, laws, population, colonies, military force, revenue, and political relations. 3. *Civil geography*, comprehendig manners and customs, language, literature, and the arts, education, cities and towns, principal edifices, roads, manufactures and commerce. And, 4. *Natural geography*, comprehending an account of the climate and seasons, face of the country, its soil, and state of agriculture, its rivers, lakes, mountains, and forests, and an enumeration of the natural productions and natural curiosities, which are usually found within each district *. Descriptive geography is sometimes styled *political* geography, while physical or general geography is called *natural* geography.

* Vid. *Pinkerton's Geography*, vol. i. p. 3.

Among the other departments of this study we may mention sacred geography, or that which illustrates the sacred writings; and ecclesiastic geography, which describes the division of a country according to its church government, as into archbishoprics, bishoprics, &c.

Many writers of treatises or systems of geography give a detailed account of the historical events and commercial concerns of the several countries which they decribe; but we consider this as unnecessary in a pure geographical work, as these departments belong rather to HISTORY and *POLITICAL Economy*.

Some systematic writers on geography considering the term in a very comprehensive view, as including a description of the internal structure of the earth, as well as of its surface, have thought it necessary to enter into discussions respecting the original formation of the earth, and the minerals of which it is composed. How far they are right in this we shall not pretend to determine. In this work, these subjects will be treated of under the articles GEOLOGY and MINERALOGY.

Another subject relative to the affections of the earth, respects the physical and chemical changes that take place in its atmosphere. These properly belong to the science of METEOROLOGY, and will be found under that article.

3 Object of this treatise.

We propose in this article to offer only an introductory outline of descriptive geography, as the several quarters of the globe, and their subdivisions into empires, kingdoms, and states, are described as particularly as is compatible with the limits of this work, under the several articles to which they belong in the general alphabet.

Our attention will be chiefly directed to physical geography, especially that part of it which describes the construction and use of globes, maps, and charts.

4 Of physical geography.

Physical geography is properly a branch of mixed mathematics, and its principles depend on geometry, and its kindred sciences, trigonometry and perspective. It is intimately connected with astronomy; and as these two sciences mutually illustrate each other, they are commonly taught at the same time. The physical changes that take place on the earth, as far as it is considered in its general character of an individual of the solar system, have been already explained under ASTRONOMY; and we shall have little here to add respecting them, except as they are modified by the situation of the observer on different parts of the earth's surface.

The principles and practice of physical geography, though strictly dependent on pure mathematics, may be, for the most part, explained in a popular way, so as to be understood by the generality of readers. This popular view of the subject we shall attempt in the present article, throwing every thing that is purely mathematical into the form of notes. It must be evident, however, that a reader who is conversant with mathematics will study physical geography to more advantage; and for this purpose, it will be sufficient to possess a moderate acquaintance with arithmetic, the elements of geometry, plane trigonometry, spherics, and perspective.

5 Importance of geography.

It is scarcely necessary to enlarge on the importance or utility of geography. It is one of those sciences, the knowledge of which is almost constantly required. Without an acquaintance with the geography of the countries that are the scenes of the actions which he relates, the historian must either be extremely concise, or his narration must be obscure and unintelligible. Geography affords the best illustration of history, and is equally necessary to the historian and his reader. To the traveller, under which denomination we may class the soldier, the sailor, the merchant, as well as those who travel for pleasure or curiosity, a previous knowledge of the countries, through which he is to pass, is always useful, and often indispensable. To the politician a comprehensive knowledge of geography is of the highest importance. If he is ignorant of the extent, form, boundaries, appearances, climates, &c. of the country with which he is at war, he will plan his hostile expeditions without effect, and will send his invading armies only to perish among the defiles of the enemy, or to meet a more inglorious and deplorable fate from the diseases of the climate.

Even, if we consider geography as a study of mere amusement and curiosity, it forms one of the most rational and interesting studies in which we can engage. Nothing can be more gratifying to the observer of mankind than to survey the manners and customs of various

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rious nations, and to compare the relative state of civilization and improvement in countries widely remote from each other. The student of geography can sit in his closet, and accompany the adventurous traveller in his toilsome journey, through

——————" antres vast, and deserts wild,
Rough quarries, rocks, and hills, whose heads touch heav'n!"

trace his progress over the boundless ocean, and draw from his narration a delightful fund of instruction and amusement, free (except in imagination) from those perils and hardships, which the writer had undergone.

At the end of this article, we shall offer a few remarks on the best method of teaching and learning geography. We must now take a brief view of the origin and progress of the science.

PART I. HISTORY AND PRESENT STATE OF GEOGRAPHY.

6
History of Geography.

AN historical account of geography would be extremely interesting, as it would include, not only the progressive improvements of the science, considered as a branch of mixed mathematics, but an account of the successive discoveries of different parts of the earth that have been made by the more civilized communities. Such an account in detail, however, cannot be expected here; and we shall confine ourselves principally to a cursory view of the geographical discoveries of ancient and modern nations, reserving the progressive improvements of physical geography for those parts of the article to which they properly belong; as they would neither be so interesting nor so intelligible to a general reader, before he has been made acquainted with the principles of the science.

7
Origin.

As soon as mankind had formed themselves into societies, and begun to establish connexions with their neighbours, they would find it necessary to inform themselves of the position of the countries which bordered on their own; and very soon their curiosity would lead them to desire to form an acquaintance with the extent of the country in which they lived, and with many particulars respecting those which were remote from them. Thus, we see that scarcely had the sciences arisen among the Greeks, before their philosophers began to occupy themselves in geographical pursuits. We are told that Anaximander exhibited to his countrymen a plan of Greece and the neighbouring countries, and in this he was imitated by his countryman Hecatcus of Miletus. Of the nature of these ancient plans or maps, and their progressive improvements, we shall speak more at large hereafter.

Discoveries of the Phœnicians.

Commerce, and the taste for adventures, which usually accompanies it, were doubtless among the first causes of geographical researches; but the Phœnicians are the earliest commercial people of whose discoveries we have any correct accounts. This people seem first to have investigated the coasts on the Mediterranean; and their navigators, extending their voyages beyond this sea, through the narrow channel which is now called the Straits of Gibraltar, entered the Atlantic ocean, and planted colonies in Iberia, a part of Spain, in the country of Tharshish, which is probably the modern Andalusia, and upon the western shores of Africa.

The learned Bochart, led by the analogy between the Phœnician tongue, and the oriental languages, has followed the tracks of the Phœnicians, both along the shores of the Mediterranean, and those of the Atlantic. These analogies are not always sure guides; but we can scarcely doubt that the city of Cadiz was a Phœnician colony, and it is not likely that this was the only one formed by that enterprising people.

9
Situation of Ophir.

In the time of Solomon, Phœnician ships, employed by him, set sail from a port in the Red sea, called Azion-Gaber, and passing from that sea through the straits of Babelmandel, carried on their commerce in the Indian ocean. The country of Ophir, to which they sailed, must have been at a considerable distance from the Red sea, as we are told that a voyage thither required three years. "The king (says the author of the first book of Kings) had a navy of Tharshish, with the navy of Hiram. Once in three years came the navy of Tharshish, bringing gold and silver, ivory, and apes and peacocks." Some have placed Ophir upon the coast of Africa, where the modern Sofala is situated: Others suppose it was a port in the island of Ceylon, or in the island of Sumatra, in which latter island there is still a place called Ophir. The gold dust and ivory brought from thence, seem to shew that it was an African port. (See OPHIR). M. Montucla supposes that the Phœnicians must even at this period have sailed round the continent of Africa, and that Ophir was some place on the Gold Coast (A).

Montucla Hist. de Mathem. p. 590.

10
Carthaginians.

The Carthaginians, a Phœnician colony, imitated their predecessors. We know that they sailed into the Atlantic ocean, as far as the coast of Cornwall in England, whence they procured large quantities of tin. The same people made several attempts towards a complete survey of the western coast of Africa. Of these we have an account only of one expedition, that of Hanno, of which we have already given an account under the article AFRICA.

The Carthaginian navigators, if we may believe the recital of Diodorus Siculus, (lib. xv.) discovered a country situated in the Atlantic ocean, which furnished all the necessaries and conveniences of life. Some pretend that this country was America, but it is much more probable that it was some one of the Cape de Verd islands.

(A) The most celebrated writers who have supported the opinion, that Ophir was a port in Africa, are Montesquieu, Bruce, and d'Anville. Dr Prideaux and M. Gosselin again contend, that Ophir was a port in Arabia Felix, and the same with *Sabéa* or Sheba; and their opinions have lately been ably supported by Dr Vincent. See *Vincent's Periplus of the Erythrean Sea*, Part II.

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islands. The Carthaginian senate, fearful that the relation of the sailors who had discovered such a country, might be the means of producing frequent emigrations, are said to have used every endeavour to stifle the memory of this expedition.

11 Circumnavigation of Africa.

History speaks of several voyages undertaken by order of the kings of Egypt and of Persia, for the purpose of ascertaining the extent of Africa; and Herodotus relates that Pharaoh Necho, king of Egypt, employed some Phœnician navigators to sail along the coast of Africa, for the purpose of taking a more exact survey of it. See AFRICA.

M. Gosselin, who has considered the geography of the ancients in a very learned dissertation, maintains, that the different passages of ancient writers, who have always declared that the Phœnicians and the Greeks circumnavigated Africa, are not sufficient to prove the certainty of such a voyage. The passage in Herodotus has been discussed by him at considerable length, and he seems to have proved his relation to be nothing more than a romance, founded on the historical knowledge of the Egyptians. M. Gosselin, however, admits, that many ancient voyages took place from those countries in which geography had arrived at some perfection; and there are numerous arguments, proving that all the shores of the old continent had been sailed round. See *Bailly's History of Astronomy*, p. 307. edit. 1755.

12 Voyage of Sataspes.

Xerxes king of Persia, according to Herodotus, gave a similar commission about the year before Christ 480, to one of his satraps named Sataspes, who had been condemned to die. Sataspes entered the Atlantic ocean through the straits of Gibraltar, and bending his course towards the south, he coasted the continent of Africa, till he doubled a cape which was called Syloco, and which Riccioli considers as the same with the Cape of Good Hope. He is said to have continued his course to the south for some time, and then to have returned home, assigning as a reason for not proceeding farther, that he had encountered a sea so full of herbage, that his passage had been completely obstructed. This reason appeared so ridiculous to Xerxes, that he ordered Sataspes to be crucified; but in this sentence he appears to have been rather too precipitate, as it is certain that in some latitudes there grows such a quantity of sea weed, that a vessel can scarcely make way through it; as in that part of the sea which lies between the Cape de Verd islands, the Canaries, and the coast of Africa, and is called by the Portuguese the sea of Saragossa. This shews that the relation of Sataspes may have been correct, as he might think it dangerous to attempt proceeding where he found himself so much entangled.

13 Expedition of Scylax.

Herodotus has commemorated another marine expedition, undertaken by Scylax, by order of Darius the son of Hystaspes, and which probably took place about the year 422 B. C. Scylax embarked upon the river Indus, the course of which he followed to its mouth, from whence he sailed in the course of 30 months, either into the Arabian gulf, or the Red sea. This Scylax must not be confounded with a navigator of the same name, who, at a later period, made a voyage of investigation round the Red sea.

14 Geography improved by Alexander.

The conquests of Alexander the Great, if they added little to the happiness of mankind, had at least the advantage of throwing considerable light on the state of geography at that time, as they afforded to the Greeks a more perfect knowledge of the river Indus, and of many parts of that vast country which derives its name from that river. Alexander does not seem to have penetrated to the Ganges, though his expedition led the way to the knowledge of that river; for soon after he went as far as Palibothra, a town situated on the river Indus, at its confluence with another river coming from the west. The followers of Alexander went down the Indus, as far as its opening into the Indian ocean, where they witnessed for the first time the phenomenon of the flux and reflux of the sea,—a phenomenon which excited in them great astonishment and terror. It was after this that Alexander detached, about the year 327 before Christ, two of his captains, Nearchus and Onesicritus, to investigate the coast of the Indian sea. Nearchus was ordered to return by the Red sea, and this he effected. Some fragments of his voyage have come down to us, and upon these has been formed an excellent work by Dr Vincent, entitled the "Periplus of the Erythrean Sea." This learned and valuable work is just completed by the publication of the Second Part, and affords much additional illustration of the geographical information and commercial enterprises of the ancients.

Onesicritus sailed to the east, and if we may believe the account that is left of his voyage, he gave us the first exact information respecting the island of Ceylon. The measure given by Onesicritus, of the extent of the island which he investigated, viz. 7000 stadia, does not correspond to Ceylon, whether we consider the length or circumference of the island, (see CEYLON); and if we take it as the measure of the length, it more nearly corresponds to that of Sumatra. The relations of Nearchus and Onesicritus were extant in the time of Strabo, by whom the latter is said to exceed, in point of exaggeration, all the other historians of Alexander's expedition. At the same time, it must be acknowledged that there are many things related by Onesicritus, as quoted by Strabo, which sufficiently agree with what we know of India, and the productions of that country: for he speaks of the sugar cane, the cotton plant, the bamboo, &c.

15 By Ptolemy Philadelphus.

The kings of Egypt who succeeded Alexander, took considerable interest in the progress of geography. The second of these kings, Ptolemy Philadelphus, about the year 280 before Christ, sent into India two ambassadors, Megasthenes and Daimachus, accompanied by the mathematician Dionysius. Megasthenes was sent to the king of Palibothra on the banks of the Ganges, and Daimachus to another Indian potentate. No account remains of the proceedings of Dionysius and Daimachus, but Megasthenes left an account of his journey, which is frequently quoted by Strabo, by whom it is considered as a mixture of real adventures and improbable exaggerations. These quotations of Strabo are certainly all that remain of the relation of Megasthenes; for the work published under the name of Megasthenes is a literary imposture, similar to the works of Berosus, Manetho, and Ctesius.

16

In the reign of Ptolemy Lathyrus, about 115 years before Christ, other expeditions were undertaken, for the purpose of sailing round the continent of Africa.

Eudoxus and Cysicus having incurred the displeasure of Ptolemy, were sent on this voyage of discovery. They

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They passed through the straits of Gibraltar, and circumnavigating Africa, returned by the Red sea. Lastly, in the reign of Ptolemy, surnamed Alexander, about 90 years before Christ, Agatarchides, who had been the king's governor, was sent to take a complete survey of the Red sea, and wrote an account of his voyage, of which, however, there remain only a few extracts that are preserved by Photius, in his Bibliotheca, a work of the ninth century.

17 Voyage of Pythias.

The extension of commerce seems always to have been one of the principal objects of these voyages of discovery. It is not surprising, therefore, that the inhabitants of Marseilles, which was early celebrated as a commercial city, appear among the ancient navigators who laboured to extend geographical knowledge. Two voyagers, Pythias and Euthymenes, undertook an expedition about 320 years before the Christian æra. Euthymenes entered the Atlantic through the straits of Gibraltar, and turned towards the south, for the purpose of taking a survey of the coast of Africa. This is all that we know of his route; but Pythias steered northward, and after reconnoitring the coasts of Spain and Gaul, sailed round the island of Albion, and stretching still farther to the north, discovered an island which is believed to be the modern Iceland, or the Thule of the ancients, *terrarum ultima Thule*. Perhaps, however, this was only one of the Ferro islands. Strabo, who appears to have been prejudiced against Pythias, treats his relation as fabulous, founding his opinion principally on the number of incredible circumstances that occur in his narration. Taking these circumstances, however, not according to their literal meaning, but in a figurative sense, they represent pretty well the state of the sea and sky in these countries which are so little favoured by nature. Pythias certainly seems to have been one of the first Greek navigators who entered the Baltic.

18 Ancient geographers.

We have thus traced the progress of geographical discoveries to very nearly the period which we assigned as the limit of ancient geography; and shall now notice very briefly some of the principal scientific geographers of antiquity, whose names or writings have descended to posterity, and shall afterwards give a summary sketch of the knowledge which the ancients seem to have possessed of the habitable globe.

As geography is a branch of knowledge intimately connected with geometry and astronomy, it became an object of consideration with many of the ancient geometers and astronomers. We have already mentioned the names of Anaximander of Miletus, and his countryman Hecateus. Strabo also notices Democritus, Eudoxus of Cnidos, and Parmenides, to the last of whom he attributes the division of the earth into zones. These were followed by Eratosthenes, who lived about 240 years before the Christian æra, and Hipparchus, who flourished about 80 years afterwards; Polybius, Geminus, and Possidonius. Eratosthenes wrote three books on geography, of which Strabo criticises some passages, though he frequently defends him against Hipparchus, who often affects an opposite opinion. Polybius wrote on geography as well as history, and, as well as Geminus and Possidonius, is frequently quoted by Strabo. Polybius and Geminus argue with considerable acuteness for the possibility of the torrid zone being inhabited, a circumstance which was generally disbelieved by the ancients; and they even adduce arguments which are very plausible, to prove that the climate of the countries under the equator is more temperate than that of those which are situated near the tropics.

We must not here omit a geographer and mathematician who lived about the time of Alexander the Great. This was Dicearchus of Messina, the disciple of Theophrastus, who wrote a description of Greece in iambic verses, of which some fragments yet remain. What renders this work most remarkable is, that it contains the height of several mountains measured geometrically by Dicearchus. Thus, for instance, the height of Mount Cylene is stated at 15 stadia, and that of Satabyce at about 14. Taking the stadium at $94\frac{1}{2}$ toises, we have for the latter of these heights, at most 1400 toises, whereas many of the ancients assigned 300, 400, or even 500 stadia, as the height of some of their mountains.

With Dicearchus we may mention another geometer noticed by Plutarch in his life of Paulus Emilius; viz. Xenagoras, a disciple of Aristotle, who also employed himself in measuring mountains, and has assigned only 15 stadia, which is equal to about 1417 toises, as the height of Mount Olympus. In some of the later periods previous to the Christian æra, we find the names of several geographers, as Artemidorus of Ephesus, who wrote a geographical work in eleven books, of which nothing remains; Scymnus of Chio, author of a description of the earth in iambic verses, which remains in a very mutilated state; Isidorus of Charax, who left a description of the Parthian empire, and Scylax of Caryades, author of a voyage round the Mediterranean sea, which is still extant.

The works of all these geographers, however, are trifling when compared with the geography of Strabo, a work in 16 books, which has come down to us entire. This is one of the most valuable works of antiquity, both from the spirit of discussion which runs through it, and the number of curious observations which the author has collected of different geographers and navigators who preceded him; and of whose works nothing remains except these extracts. Strabo lived in the reigns of Augustus and Tiberius, and was nearly cotemporary with Pomponius Mela. This latter geographer wrote a work *de situ orbis*, which is little more than a bare summary, though it is valuable, as it gives us a sketch of what was known in his time respecting the state of the habitable globe. Pomponius Mela was followed by Julius Solenus, who has also treated of geography in his Polyhistor, a compilation which is sufficiently valuable from the number of curious observations which are there collected. 19 Strabo. 20 Pomponius Mela.

Of all the ancient geographers, posterity is most indebted to Ptolemy, who produced a work much more scientific than had ever before been written on this science; a geography in eight books, which must ever be considered as one of the principal monuments of the labours of its author. In this work there appear, for the first time, an application of geometrical principles to the construction of maps; the different projections of the sphere, and a distribution of the several places on the earth, according to their latitudes and longitudes. This work must have been the result of a great many relations both historical and geographical, that had been collected by Ptolemy. It has passed through numerous editions. 21 Ptolemy.

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22 Dionysius the Periegetic.

Some time after Ptolemy, lived Dionysius the African, commonly called the *Periegetic*, from the title of a work that he composed in verse, containing a description of the world, which may be considered as one of the most correct systems of ancient geography, and was by Pliny proposed to himself as a pattern. This work was afterwards translated into Latin verses by Priscian, and by Avienus, the latter of whom also wrote a description of the maritime coasts in iambic verses, of which there remain about 700. Among the latest geographers of this period are reckoned Marcianus and Agathemares, of whom little is known, except that the latter was author of two books on geography.

23 Hudson's collection.

The scattered works of most of these authors being difficult to procure, were collected by Hudson into one work, and published by him in four volumes octavo, in the years 1698, 1702, and 1712, under the title of *Geographiæ veteris scriptores Greciæ minores*, together with a Latin translation, and notes and dissertations on each by Dodwell. In this work we find the remains of Hanno, Scylax, Nearchus, Agatarchides, Arrian, Marcianus, Dicearchus, Isidore of Charax, Scymnus, Agathemares, Dionysius the Periegetic, Artemidorus, Dionysius of Bisance, Avienus, Priscian, and some fragments of Strabo, of Plutarch, of Ptolemy, of Albulfeda, and of Ulug Beg. This is a most valuable collection, and as it had become extremely scarce, was a few years ago reprinted at Leipsic.

24

The above is a hasty sketch of the names and characters of most of the geographical writers within the period which we have assigned to the ancient history of the science. We shall have occasion to make some further observations on the more eminent of these geographers in a future part of this article.

25 Geographical knowledge of the ancients.

With respect to the knowledge of the globe that was possessed by the ancients, there have been various opinions; some have considered them as very extensively acquainted with almost every part of it, not excepting some portion of America; while others have confined their geographical knowledge within very narrow limits. The following observations are chiefly drawn from M. Montucla, an eminent judge in every thing that relates to the history of the mathematical sciences.

26 Europe.

As to the knowledge which the ancients possessed of the habitable globe, it is certain that they were well acquainted with Europe, or at least all that part of it which had been made subject to the Roman empire, as far as the banks of the Rhine and the Danube. They were tolerably well acquainted with Germany and Sarmatia. They had some knowledge of the Baltic sea, as a fleet had been sent by Augustus, which sailed as far as the peninsula then called the Cimbrian Chersonesus, the modern Jutland. The Baltic was at that time celebrated for the production of ambergrise. They had acquired a knowledge of the island of Britain, from the expeditions of Julius Cæsar and Claudius; but the northern parts of this island, and the whole of Ireland, were to them nations of rude, uncivilized savages. The boundary of their knowledge of Europe to the north, was the Thule of Pythias, or Iceland; at least if it is certain, as is the general opinion, that this island is the *ultima Thule*.

27 Asia.

With respect to Asia, they seem to have surveyed the country as far towards the east as the river Ganges; and the immense extent of country comprehended between the Indus and the Ganges, was called by them *India on this side the Ganges*. Further on towards the north of China, in the neighbourhood of the mountains where these rivers derive their source, they placed several nations of people, of whom they related the most ridiculous fables. Beyond these, still more towards the east, they placed the Seres, and upon the coast of the gulf, which is now the bay of Cochin China, called by Ptolemy the Great Bay, were situated the Sinæ, so called by Ptolemy, though they are not mentioned by Strabo, Pomponius Mela, or Solinus. The Seres were probably the inhabitants of the northern parts of China, and the Sinæ, those of the southern parts of China, who very early occupied Cochin China, Tonquin, &c. countries which in the sequel they have entirely subjugated. They maintained a commerce by land with the Seres, and their route is pointed out in one of Ptolemy's maps. Beyond the Seres, according to Strabo and Pomponius Mela, lay between the Oriental sea, though Ptolemy, for want of certain intelligence respecting that part of Asia, considers the point as undecided, and places there several unknown countries. The ancients carried this extremity of Asia much farther to the east than it is found to extend by modern geographers; for, according to them, the Seres and the Sinæ were situated about the longitude of 180°, while the meridian of Pekin, or about the middle of the Chinese empire, reaches no farther than to 134°, reckoning the longitude from the most distant of the Canary islands, as was done by Ptolemy. To the north of the Indus the ancient geographers placed the Scythians, and Hyperboreans (the Tartars and Samoiedes of more modern date) and some other nations to an indefinite extent, who were supposed to form on that side an insurmountable barrier, having behind them an ocean of ice, which was believed to communicate with the Caspian sea, though this was at least at the distance of 450 leagues.

The boundary of Asia, assigned by the ancients to the south, was the Indian ocean, and they were acquainted with its communication with the Red sea, by means of a strait, the figure of which is very ill expressed in their maps. This is also the case with the Persian gulf, with which they were acquainted, but which in the ancient maps has nearly the form of a rhombus, one side of which, towards the mouths of the Indus, was pretty well known to them, but the side next the mouths of the Ganges is very inaccurately delineated, being continued nearly in a straight line. It is even probable that the island which Ptolemy calls Taprobana, was only the peninsula of India very much disfigured in the delineation.

28 Situation of the Taprobana.

The situation of this island of Taprobana, so celebrated among the ancients, is a problem in geography that is yet unsolved. It is commonly supposed to be the modern island of Ceylon; but the dimensions of it as laid down by ancient geographers, render this supposition doubtful, and there are some who rather believe it to be the modern Sumatra. The ancients had also some obscure knowledge of the peninsula of Malacca, which they called the *Golden Chersonesus*; and they seem to have examined the gulf formed by that land, which is now the gulf of Cochin China, or commonly called the *gulf of Tonkin*. It is somewhat extraordinary that they do not seem to have been acquainted

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quainted with Java, Borneo, and that numerous group of islands which form, in that quarter, the greatest Archipelago in world. It is equally singular that the Maldives had escaped the observation of these navigators. This seems to prove that they never ventured out into the open sea, but kept close along the shore. Ptolemy indeed says, that his island of Taprobana was surrounded with many hundreds of smaller islands, to some of which he gives names; but all this is involved in impenetrable obscurity.

29 Africa.

Of Africa, the ancients knew only those parts which lay along the coast, and to a very small distance inland, if we except Egypt, with which they were well acquainted, at least as far as the cataracts of the Nile, and a little beyond them, as far as the island of Meroë, towards the 20th degree of north latitude. Their knowledge of the coasts of Africa on the side of the Red sea, extended no farther than the shores of that sea, except that part which was dependent on Egypt; the interior of the country being inhabited by ferocious and untractable people. They were still less acquainted with the countries which lay beyond the strait, and Ptolemy appears to have given no credit to the navigators who were said to have sailed round that part of the world, for he has left the continent of Africa imperfect towards the south. Strabo and Pomponius Mela were, however, decidedly of opinion that Africa was a peninsula, and that it was joined to the rest of the continent only by that narrow neck of land which is now called the isthmus of Suez. The ancients seem to have had no knowledge of that large and beautiful island of Madagascar, unless we suppose that Ptolemy had some imperfect acquaintance with it, under the name of the island *Menuthius*. The coast of Africa upon the Mediterranean sea, was once covered with towns, dependent on the Roman empire, flourishing and polished, while it presents at present nothing but a nest of pirates, whom the jealousy of the great commercial nations supports, to the disgrace and prejudice of civilized states. Proceeding from the straits of Gadez or Gibraltar, they had become acquainted with the coast as far as a cape which they called *Hesperion-Keras*, probably the modern Cape de Verd, or the cape that lies a little to the west of it, though in the maps of Ptolemy it is thrown a little back inland. The Fortunate islands, or the Hesperides, at present the Canaries, better known by fame than in reality, seem to have been the boundaries of ancient geography to the west, as the Seres and Sinæ were to the east. It appears, however, that the Cape de Verd islands were not entirely unknown to the ancients, and they are probably the same with what were then called the Gorgades or Gorgones, which were supposed to be two days sail to the west of Hesperion-Keras.

"There is little doubt (says Mr Patteson) concerning the names by which most of the principal countries of Europe were known to the ancients; nor is there any difficulty in disposing the chief nations, which ancient writers have enumerated in the south-west part of Asia or on the African coast of the Mediterranean; but with the north and north-east parts of Europe, about two-thirds of Asia towards the same quarters, and nearly the same proportion of Africa towards the south, they appear to have been wholly unacquainted. Of America they did not even suspect the existence; and if it ever happened, as some writers have imagined, that Phœnician merchants ships were driven by storms across the Atlantic to the American shores, it does not appear that any of them returned from thence to report the discovery.

"The names of provinces, subdivisions, and petty tribes, mentioned by ancient authors, in those countries which were the chief scenes of Roman, Grecian, or Israelitish transactions, are almost as numerous as in a modern map of the same countries; and the situations of many of them can be very nearly assigned: but the limits of each, or indeed of the states or nations to which they belonged, can, in very few instances, be precisely fixed. Thus the southern boundaries of the Sarmatæ in Europe, cannot be ascertained within a degree at the nearest; and in France, neither the limits of the people called the Belgæ, Celtæ, and Aquitani; nor those of the Roman divisions, viz. Belgica, Lugdunensis, Aquitania, Narbonensis, and the Province, can be laid down, in many places, but by a hardy conjecture. The same observation may be justly applied to the Tarraconensis, Lusitania, and Betica of Spain; to the Cauci, Catti, Suevi, &c. of Germany; and, above all, to the Britannia prima et secunda, and other divisions of the Roman government in Britain: of which not only the limits, but the situations are still in dispute*."

* Patteson's Atlas, Part I. page 27.

31 Geography of the middle ages.

During the middle ages geography, as well as most other arts and sciences, seems rather to have gone backwards than advanced. The weakness of the Roman emperors, the relaxation of military discipline, the boundless passion for luxury and pleasure, and the continual incursions of the barbarous nations, while they contributed to hasten the fall of the western empire, also accelerated the ruin of the arts. It seems as if these destructive hordes of barbarians, the Goths, the Huns, and the Vandals, had enveloped the whole world in one profound and universal ignorance. This darkness, which overspread the whole of Europe, did not permit geography to make any advances for a very considerable time. There were indeed some navigators who investigated countries that were still little known, but they were so ignorant, that they afford us very little new light. There was one named Cosmas, who made a voyage to India, which procured him the name of Indo-Pleustes, and who gave an account of his voyage under the title of *Sacred Geography*. This man was so egregiously ignorant, as to believe that he had discovered that the earth was a plane, and that the diversity of the seasons, and the inequality of the days and nights, were owing to a very high mountain situated to the north, behind which the sun set to a greater or less depth.

32 Discoveries of the Arabians.

The voyages of the Arabians to the East Indies (see the history of COMMERCE), contributed to throw farther light on that extensive part of the globe. Conquerors of the countries on the Red sea, and enthusiastic propagators of their religion, they carried their arms as far as the extremity of India. We see them in the 9th century extending to China; and Renaudot has published two of their narrations, in which we can trace, with tolerable accuracy, the places visited by their authors. The island of Serendib, so celebrated in their tales, is certainly the modern Ceylon; for *dib* or *dit*, in the Malay language, signifies *island*, so that Serendib, signifies the island of Seren or Selan. Farther, these

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relations do not give us as favourable an idea of the Chinese as we derive from their own history; on the contrary, if we may believe these Arabian travellers, this people were, even at that time, in a state not very civilized.

33 Modern discoveries.

We are now arrived at the modern period of our history, during which the most important discoveries have been made, and our knowledge of the habitable globe more than doubled. The discoveries and improvements during this period are so numerous, that it will be impossible to give here any thing more than a chronological view of the most remarkable, referring for a detailed account of them to the geographical and historical articles in this work.

The taste for voyages of discovery began in Europe soon after the revival of literature in the 15th century, just before the commencement of which, namely, in the reign of Henry III. king of Spain, about the year 1395, the Canary islands were more fully surveyed than at any former period.

1415. Prince Henry III. son of John king of Portugal, sailed round the coast of Africa.

1417. The Canary islands were subdued by Bethancourt, nephew of the admiral of France.

1420. The island of Madeira was examined by John Gonsalvo and Tristan Vaz, two Portuguese.

1446. Cape de Verd was discovered by Dennis Fernandez.

1487. The Cape of Good Hope was discovered by Barthelemi Diaz. The discovery of this cape led the way to that of the new world. This great event, which gave a new flight to the genius of mankind, is one of the most important in the history of geography. A particular account of this discovery will be found under the article AMERICA. The following are the dates of the principal geographical discoveries which have taken place between that of Columbus, and the voyages of our celebrated navigator Cook.

1496. Florida, by Sebastian Gabot, an Englishman.
1498. The Indies, by Vasco di Gama.
1499. The river of Amazons, by Yanez Pinçon.
1500. Brazil, by Alvarez Cabral, a Portuguese.
1504. Newfoundland, by some Normans.
1518. Mexico, by Ferdinand Cortes.
1519. The straits of Magellan, South sea, and Philippine islands, by Ferdinand Magellan.
1525. Canada, by Jean Verrazan, a Florentine, sent by Francis I. of France.—Peru, by F. Pizarro of Spain.
1527. New Guinea, by Alvaro de Salvedra.
1534. Chili, by Diego Almagro.
1535. California, by Ferdinand Cortes.
1567. The islands of Solomon, by Alvaro de Mendoza.
1618. New Holland, by Zechaen.
1642. Van Diemen's land, by Abel Jansen Tasman.
1643. Brower's land.
1654. New Zealand.
1678. Louisiana, by Robert Cavelier de Lasalle, governor of Frontiniac.
1700. New Britain, by Dampier, an Englishman.
1739. Cape Circumcision, contested between the French and English. Said by Montucla to be discovered by two French vessels.
1767. The island of Taiti, by Wallis, an Englishman.
1778. The Sandwich islands, by Cook.

34 Number of voyages round the world.

Within this period there are reckoned 25 voyages round the world, viz. those of Magellan, Drake, Cavendish, Noort, Spilburg, Lemaire, L'Hermite, Clepington, Carreri, Shelvack, Dampier, Cowley, Woodes Rogers, Le Gentil, Anson, Wallis, Roggewein, Bougainville, Sarville, Dixon, three voyages of Cook, La Peyrouse, Marchand, Vancouver, and Pages.

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Within these few years, very considerable light has been thrown on the state of our geographical knowledge, by several valuable voyages and travels that have lately appeared. The discoveries that have been successively made in the great South sea, and in other parts of the world, especially the extensive island of New Holland, are now so fully established, as to add considerably to the certainty of our geographical knowledge; and the voyages of Cook, La Peyrouse, and Vancouver, have afforded us more exact surveys of the coasts of these countries, than we could, some years ago, have dared to hope for. The accounts of the late embassies to China, Tibet and Ava, afford many authentic materials for a modern system of geography, the place of which must have been supplied by more remote and doubtful information. From the latter of these accounts we are become familiarly acquainted with an empire (that of the Birmans), which a short time ago was scarcely known (see ASIA, 81—152). Our knowledge of Hindostan and the neighbouring countries has been greatly extended by the researches of the Asiatic Society, and some other late works; while our acquaintance with the interior of Africa has been rendered less imperfect by the exertions of the African Society, and by the travels of Park, Brown, and Barrow; and the northern boundaries of America, even as far as the sea which appears to surround the northern extremity of that vast continent, have been more fully disclosed by the journeys of Hearne and Mackenzie.

The late voyage of Turnbull, however insignificant it may be in other respects, has at least the merit of enlarging our knowledge of the manners and political transactions of the South sea islanders, and of introducing to our acquaintance, in the person of Tamahama, the chief of Owhyhee, a sovereign, who, in ambition and desire of improvement, bids fair to vie with Peter the Great, and to transform a nation of savages, to a civilized people.

36 Present defects of geography.

With all the advantages which geography has lately received, the science is still far from being perfect; and the exclamation which D'Anville is said to have made in his old age, "Ah! mes amis, il y a bien d'erreurs dans la geographie"—*Ah! my friends, there are a great many errors in geography*, may still be applied with considerable justice. Many points in the science have been but very lately ascertained. Thus, the extent of the Mediterranean sea was almost unknown at the beginning of the 17th century, although it is now almost as exactly ascertained as that of any country in Europe. In a book published by Gemma Frisius, *de orbis divisione*, in 1530, we find the difference of longitude between Cairo in Egypt and Toledo in Spain stated at 53° instead of 35°, and other measures of extent are proportionally erroneous. Not many years ago there was an uncertainty with respect to the extremity of the Black sea and the Caspian, to the amount of 3° or 4°; and

and so lately as the year 1769, the longitude of Gibraltar and of Cadiz was not known within half a degree.

Many parts of the geography of Europe are still very defective; Spain and Portugal have been but imperfectly explored, and European Turkey is still less known. It may appear extraordinary that we have yet no correct chart of the British channel, though we are assured by Major Rennel that this is the case; and it has been proved by the trigonometrical surveys of Britain that have yet been published, that there are many gross errors in our best county maps. We have had occasion to remark that geography has sometimes been retrogressive, and there cannot be a greater proof of the truth of the observation, than that in a map of the Shetland islands, published not long ago, by Preston, they are represented as too large by one third, both in length and breadth, and their relative positions are very inaccurate, though in the maps of the same islands published before the year 1750, they are laid down with much greater accuracy, as appears from surveys made by order of the late king of France, and from the maps published by Captain Donelly, and at Copenhagen, in the year 1787.

In Asia we are imperfectly acquainted with Thibet, and some other central regions; and even Persia, Arabia, and Asiatic Turkey, are but little known. Of Australasia, or New Holland, and New Guinea, almost nothing is known except the coasts, and a great part of them towards the south has been but imperfectly explored. Of Polynesia, or the numerous islands in the South Pacific ocean, we are also very ignorant; and in the Pacific ocean, particularly towards the south pole, many discoveries probably remain to be made.

Our ignorance of the central parts of Africa is notorious, and the improvement of our geographical knowledge in that quarter has, for some years, been a favourite object. It may admit of doubt, however, whether this object will be speedily attained, as the obstacles to investigation in those inhospitable tracts, seem nearly insurmountable by human prudence and courage. Even the shores of Africa have not been completely surveyed, especially those towards the south and east.

America has of late been much more fully explored than at any former period: but still the western parts of North America, and the central and southern regions of South America are very little known; and the Spanish settlements towards the north are scarcely known, except to their own inhabitants.

The science of geography will probably be never perfectly understood, as, beside the numerous obstacles which oppose the progress of the traveller, it is scarcely possible that exact trigonometrical surveys of every place and country, the only certain method of ascertaining their exact situations and relative positions, can be made.

37 Political geography must ever remain the most uncertain part of the science. New changes are perpetually taking place in the relations of neighbouring states, according as ambition, tyranny, or commercial convenience dictates. Territory is transferred, by cession or by conquest, from one nation to another. Whoever will compare the relations of the European states, as they appear in the present maps, and in those published half a century ago, will scarcely recognise the countries to be the same. The great divisions indeed remain as before, but the boundaries of most of them are entirely changed. A number of independent states, and in one instance, a large kingdom, have been swallowed up by the unjustifiable ambition of their more powerful neighbours, and their names may be blotted from the map of Europe. The republics of Holland, of Switzerland, of Venice, are no more: the kingdoms of Poland and Sardinia have ceased to exist; the successor of St Peter, who once gave laws to princes, and governed Europe with unbounded sway, is now a wretched exile, and his dominions are doomed to increase the already overgrown power of despotic upstarts. Whether the present generation of emperors and kings, erected by the mighty Napoleon, will remain as long as did the states on whose ruins they have been raised, or are rather ephemeral productions, doomed to perish at the setting of that sun which now gives them life and vigour, is a question which future experience alone can determine.

The limits prescribed to this article do not permit us to enter on a critical examination, or even a characteristic sketch of the geographical works that have appeared in the modern period of the history of the science; and a bare enumeration of names would be equally tiresome and uninteresting. Some of the best modern works will be mentioned in the sequel; at present we shall conclude this Part in the words of an able judge of the present state of the science.

"The Spaniards and Italians (says Mr Pinkerton) have been dormant in this science; the French works of La Croix and others are too brief; while the German compilations of Busching, Fabri, Ebeling, &c. are of a most tremendous prolixity, arranged in the most tasteless manner, and exceeding in dry names, and trifling details, even the minuteness of our gazetteers. A description of Europe in 14 quarto volumes, may well be contrasted with Strabo's description of the world in one volume: and geography seems to be that branch of science, in which the ancients have established a more classical reputation than the moderns. Every great literary monument may be said to be erected by compilation, from the time of Herodotus to that of Gibbon, and from the age of Homer to that of Shakespeare; but in the use of the materials there is a wide difference between Strabo, Arrian, Ptolemy, Pausanias, Mela, Pliny, and other celebrated ancient names, and modern general geographers; all of whom, except d'Anville, seem under-graduates in literature, without the distinguished talents or reputation, which have accompanied almost every other literary exertion. Yet it may safely be affirmed, that a production of real value in universal geography requires a wider extent of various knowledge than any other literary department, as embracing topics of the most multifarious description. There is, however, one name, that of d'Anville, peculiarly and justly eminent in this science; but his reputation is chiefly derived from his maps, and from his illustrations of various parts of ancient geography. In special departments Gosselin, and other foreigners, have also been recently distinguished; nor is it necessary to remind the reader of the great merit of Rennel and Vincent in our own country *."

* *Pinkerton's Geography*, p. 3.

PART

Principles and Practice.

PART II. PRINCIPLES AND PRACTICE OF GEOGRAPHY.

38

CHAP. I. *Of the Surface and General Divisions of the Earth.*

IT has been supposed, by the less enlightened part of mankind in all ages, that the surface of the earth is nearly a plane, bounded on all sides by the sky. It was shewn, however, in the article ASTRONOMY, (N° 269—272.) that the earth is of a spherical figure, and an account was there given of the manner in which the true form of it was determined. Independently of the considerations there detailed, the spherical figure of the earth may be inferred, in a popular view, from the following facts.

39 Proofs of the spherical form of the earth.

1. When we stand on the sea-shore while the sea is perfectly calm, we easily perceive that the surface of the water is not quite plain, but convex or rounded; and if we are on one side of a broad river or arm of the sea, as the frith of Forth, and, with our eyes near the water, look towards the opposite coast, we shall plainly see the water elevated between our eyes and the opposite shore, so as to prevent our seeing the land near the edge of the water.

2. When we observe a ship leaving the shore, and going out to sea, we first lose sight of the *hull*, then of the sails and lower rigging, and lastly of the upper part of the masts. Again, when a ship is approaching the shore, the first part of her that is seen from the land is the topmast, then the sails and rigging appear, and lastly the hull comes gradually into view. These appearances can arise only from the ship's sailing on a convex surface; as, if the surface of the sea was plain, a ship on its first appearance would be visible, though very small, in all its parts at the same time, or rather the hull would first appear, as being most distinguishable; and, in going out of sight, it would in the same manner disappear at once, or the hull would be the last part of which we should lose sight.

3. Many navigators sent on voyages of discovery, have, by keeping the same course, at length arrived at the port from which they set out, having literally sailed round the globe. This could not happen if the sea were a plain.

4. When we travel to a considerable distance, in a direction due north or due south, a number of new stars successively appear in the heavens, in the quarter to which we are travelling; while many of those in the opposite quarter gradually and successively disappear, and are seen no more till we return in a contrary direction.

5. In an eclipse of the moon, which has been shown (ASTRONOMY, N° 199.) to be owing to the obscuration of the moon's surface by the shadow of the earth, the boundary of the obscured part of the moon is always circular. Now, it is evident that no body, which is not spherical, can, in all situations, cast a circular shadow.

40 Magnitude of the earth.

The diameter of the earth is generally computed at 7958 miles, though Mr Vince makes it 7930, nearer the medium derived from a comparison of the polar with the equatorial axis. Taking this last, therefore, as the mean diameter, the circumference will be =24,912 miles, and consequently the extent of the superfices will be = 197,552,160 miles, of which it is computed that at least two-thirds are covered with water.

In the above computation no account is taken of the mountains and other eminences on the surface of the globe; for, although these are of considerable consequence in a geographical point of view, as they constitute the most natural and remarkable boundaries of countries, and by their influence on the soil and climate of the different regions, contribute in a great degree to form those shades of distinction which diversify the inhabitants of the several quarters of the earth, they are, however, too trifling when compared with the diameter of so great a body, to make any sensible error in the calculation.

4[illegible] Divisions of the earth.

The surface of the earth is exceedingly diversified, almost everywhere rising into hills and mountains, or sinking into valleys; and plains of any great extent are extremely rare. Among the most extensive plains, are the sandy deserts of Arabia and Africa, the internal part of European Russia, and a tract of considerable extent in the late kingdom of Poland, now called Prussian Poland. But the most remarkable extent of level ground, is the vast platform of Tibet in Asia, which forms an immense table, supported by mountains running in every direction, and is the most elevated tract of level country on the globe. The chief elevations or mountains that occur, with their elevation, &c. will be mentioned under GEOLOGY. The greatest concavities of the globe are those which are occupied by the waters of the sea, and of these by far the largest forms the bed of the Pacific ocean, which stretching from the eastern shores of New Holland to the western coast of America, covers nearly half the globe. The concavity next in size and importance, is that which forms the bed of the Atlantic ocean, extending between the new and the old worlds; and a third concavity is filled by the Indian ocean. Smaller collections of water, though still large enough to receive the name of oceans, fill up the remaining concavities, and take the names of Arctic and Antarctic oceans. 4[illegible] Oceans.

4[illegible] Seas. Pl. CCX[illegible]

Smaller collections of water that communicate freely with the oceans, are called *seas*, (vid. A; fig. 1.), and of these the principal are the Mediterranean, the Baltic the Black sea, and the White sea. These seas sometimes take their names from the country near which they flow; as the Irish sea and the German ocean. Some large bodies of water which appear to have no immediate connexion with the great body of waters, being everywhere surrounded by land, are yet called *seas;* as the Caspian sea.

Bays or gulfs.

A part of the sea running up within the land, so as to form a hollow, if it be large, is called a *bay* or *gulf;* as the bay of Biscay, gulf of Mexico: if small, a *creek*, *road*, or *haven*.

Straits.

When two large bodies of water communicate by a narrow pass between two adjacent lands, this pass is called

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called a *strait*, or *straits* (C, fig. 1.) as the straits of Gibraltar, the straits of Dover, of Babelmandel, &c. The water usually flows through a strait with considerable force and velocity, forming what is called a current, and frequently this current always flows in the same direction. Thus, in the straits of Gibraltar there is a constant current from the Atlantic into the Mediterranean, though the surface of the latter never seems to be elevated beyond its usual level. There is always a current round Cape Finisterre and Cape Ortegal, setting into the bay of Biscay, and it has been discovered by Major Rennel, that this current is continued in a direction N. W. by W. from the coast of France to the westward of Ireland and the Scilly islands. Hence he draws this useful practical instruction for navigators who are entering the English channel from the Atlantic, viz. that they should keep no higher latitude than 48° 45′, lest they should be carried by the current upon the rocks of Scilly. For want of this necessary precaution, it is said that many ships have been lost on these rocks.

Lakes. A body of fresh water, entirely surrounded by land, is called a *lake*, *loch*, or *lough* (as D, fig. 1.), with the exception of the sea above mentioned; as the lake of Geneva, Lake Ontario, Lake Champlain, Loch Lomond &c.

This term, or its synonimes, loch or lough, is sometimes applied to what is properly a gulf or inlet of the sea, as Loch Fyne in Scotland, and Lough Swilly in Ireland.

Rivers. A considerable stream of water rising inland, and running towards the sea, is called a *river*; a smaller stream of the same kind is called a *rivulet* or *brook*. Vid. E, fig. 1.

Continents. The great extent of land which forms the rest of the globe, is divided into innumerable bodies, some of which are very large, but the majority extremely small. There are three very extensive tracts of country, which may all be denominated continents, though only two of them have hitherto been distinguished by that appellation. The most considerable of these continents is what has been called *the old world*, comprising Europe, Asia, and Africa. The second comprehends North and South America, or what has been denominated *the new world*, and is little inferior in extent to the former. The third great division forms the country called New Holland.

Islands. A body of land entirely surrounded by water is called an *island*, (vid. *a*, fig. 1.) as Britain, Ireland, Jamaica, Madagascar, &c. According to the strict meaning of this definition, the large divisions just mentioned are islands; for it is almost certainly ascertained, that the continent of North America is everywhere bounded by the sea, and it has long ceased to be doubtful that New Holland is in the same circumstances, and it is generally called the largest island in the world. But perhaps it would be better to confine the term to those numberless smaller islands that appear above the surface of the waters. When a number of smaller islands are situated near each other, the whole assemblage is commonly called a group of islands, as *b*, *b*. The large assemblages of islands that have been discovered in the South Pacific ocean, have lately been comprehended under the name of Polynesia, constituting a sixth division of the whole earth; the other five being Europe, Asia, Africa, America, and the islands of New Holland and New Guinea, under the name of Australasia.

A body of land that is almost entirely surrounded by water is called a *peninsula*, as *c*, fig. 1.; as the peninsula of Malacca, the Morea, or Grecian Peloponnesus, &c. Indeed the continent of Africa may be considered as a vast peninsula, being united to Asia only by the small isthmus of Suez. 51 Peninsula.

The narrow neck of land which joins a peninsula to the main land, or which connects two tracts of country together, is called an *isthmus*, as *d*. The most remarkable isthmuses are the isthmus of Darien, connecting the continents of North and South America, and the isthmus of Suez, joining Africa to Asia. 52 Isthmus.

A narrow tract of land stretching far out into the sea, being united to the main land by an isthmus, is called a *promontory*, and its extremity next the sea, is called a *cape*, as *e f*, fig. 1. The most remarkable capes are the Cape of Good Hope, at the southern extremity of Africa; Cape Horn at the southern extremity of South America; the North Cape at the northern extremity of Europe; and Cape Talmara, at the northern extremity of Asia. 53 Promontory and Cape.

It may assist the memory of the young geographer, to compare together the above divisions of land and water. We may remark that the large bodies of land, called continents, correspond to the extensive tracts of water called oceans; that islands are analogous to lakes; peninsulas to seas or gulfs; isthmuses to straits; promontories to creeks, &c.

The inhabited parts of the earth are calculated to occupy a space of 38,990,569 square miles, of which the four quarters into which the globe is usually divided are supposed to have the following proportions:—

Europe,	4,456,065
Asia,	10,768,823
Africa,	9,654,807
America,	14,110,874

The whole population of the earth has been computed at 700,500,000 souls; and of these

Asia is supposed to contain	500,000,000
Europe,	150,000,000
Africa,	30,000,000
America,	20,000,000
and Australasia and Polynesia, &c.	500,000

Hence the proportional number of inhabitants to every square mile in each quarter is as follows:—

In Asia	46
Europe	34
Africa	3
America	3 to every two square miles.

Chap. II. *Of the Construction and Use of the Globes.*

Sect. I. *Description and Use of the Terrestrial Globes.*

For the purpose of representing more accurately the globe which we inhabit, geographers have long had recourse to spherical balls, on the face of which are drawn the various divisions of the earth, and which are fitted up with such an apparatus, as enables us to illustrate and explain the phenomena produced by the motions 54 Nature of the globes.

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tions of the earth, and the different situations of its various inhabitants. The ball thus prepared, is called an *artificial globe*, and what we have described is properly the *terrestrial globe*, so called to distinguish it from another of a similar form, and furnished in a similar manner, but the surface of which represents the various assemblages of stars or constellations that appear in the heavens, and therefore this is called the *celestial globe*.

55 Circles on the globes.

In order to ascertain the relative positions of places and countries on the earth, certain circles are supposed to be drawn on its surface, analogous to those which were mentioned in ASTRONOMY, as supposed to be drawn in the heavens. As these circles are really represented on the artificial globes, it will be proper here to consider a little more particularly their nature and uses.

56 Axis and poles.

As the earth turns about on an imaginary axis, once in 24 hours, the artificial globe is furnished with a real axis, formed by a wire passing through the centre, and on which the globe revolves. The two extremities of this axis are its poles, the one being called the *north*, and the other the *south pole*.

57 Equator or equinoctial.

A great circle drawn on the globe, at an equal distance from both poles, is the equator or equinoctial line, and represents on the globe a similar circle, supposed to be drawn round the earth, and distinguished by the same name. By sailors this is commonly called the *line*, and when they pass over that part of the water, where it is imagined to be drawn, they often make use of various superstitious ceremonies. The two parts of the globe into which it is divided by the equator, are called the *northern and southern hemispheres*.

The equinoctial line on the earth passes through the middle of Africa, in the almost unknown territories of Macoco, and Monemugi, traverses the Indian ocean, passes through the islands of Sumatra and Borneo, and the immense expanse of the Pacific ocean; then extends over the province of Quito in South America, to the mouth of the river Amazons.

As every circle is supposed to be divided into 360°, so the equator is thus divided on the artificial globe.

58 Meridians.

Through every 15° of the equator there is drawn on the globe a great circle passing through the poles. These circles are called *meridians*, because when the sun in his apparent course from east to west reaches the corresponding circle in the heavens, it is noon on that part of the earth over which the meridian is supposed to pass. Properly speaking, every place on the earth has its own meridian, though to prevent confusion, these circles are drawn on the artificial globe, only through every 15° of the equator. To supply the place of the other meridians, the globe is hung in a strong brazen circle, which is called the *brazen meridian*, or sometimes only the *meridian*. The brazen meridian, like the equator, is divided into 360°, but these are marked by nineties on each quadrant, being on one half of the meridian numbered from the equator to the poles, and on the other half from the poles to the equator. On the opposite side of the brazen meridian there are two concentric spaces, which are divided into degrees corresponding to the months and days of each month, the degrees being marked on concentric spaces from the north pole to about 23½° both ways. The use of these divisions will appear hereafter (B).

Brazen meridian.

Through every tenth degree of the meridians, there are drawn on the globe circles parallel to the equator, which, for a reason that will appear presently, are called *parallels of latitude*.

Parallels of latitude.

Before we proceed in describing the other circles, &c. of the artificial globe, we shall here make a few remarks on the uses of the equator, the meridians and parallels (C).

Of latitude and longitude.

The equator serves to measure the distance of one place from another, either to the eastward or westward, and this distance is called the *longitude* of the place. The meridians serve in like manner to measure the distance of one place from another in a direct line north or south of the equator, and the distance of the place thus measured is called its *latitude*.

The longitude and latitude of places may be illustrated in the following manner. Let PEP′Q (fig. 3.) represent the earth or the globe, (supposed to be transverse) whose axis is PCP′, the north pole being P, and the south pole P′; and let EAQR represent a circle passing through the centre C, in a direction perpendicular to the axis PP′. This circle corresponds to the equator, and it divides the earth of the globe into two hemispheres, EPQ being the northern, and EP′Q the southern hemisphere. Let G, I, K, represent the situations of three places on the surface of the globe, through which let the great circles PKP′, PIP′, and PGP′, be drawn, intersecting the equator EQ, in *n*, *m*, *a*, respectively. The circles are the meridians of the places K, I, G. As every circle is supposed to be divided into 360°, there must be 90° from each pole to the equator. Hence the latitude of the place K is measured by the degrees of the arc intercepted between K and *n*, and the latitudes of G and I are measured by the degrees of the arcs intercepted between G and *a*, and I and *m* respectively. These latitudes will be called north

(B) The meridians are properly only semicircles, reaching from pole to pole, and of these there are twenty-four.

(C) In Geography, as in other sciences, there are two methods of conveying instruction. One is, to lay down the principles of the science first, and afterwards apply these to the practice of it; the other method is, to combine the principles and practice in one view. The former is usually considered as the more scientific, but we are inclined to think that the latter is often to be preferred, as being less dry and tedious, especially to a general reader. We have here, therefore, chosen to explain the nature of latitude and longitude, and the problems respecting them, before completing the description of the globe. We shall proceed in the same manner, uniting, as far as possible, the principles and practice in one view. Making, therefore, the terrestrial globe our text book, we shall thence explain the principles of geography, rather than detail these in a separate section, and afterwards illustrate them by the globe.

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north latitudes, because the places lie in the northern hemisphere. Let there be two other places, WV, in the southern hemisphere; the latitude of W will be measured by the degrees of the arc intercepted between W and *a*; and the latitude of V by the arc intercepted between V and *m*; and these will be called south latitudes. Further, let the circle *c*, *e*, *d*, *v*, G, be drawn parallel to the equator; this circle is called a parallel of latitude, and as it does not pass through the centre, it is evidently less than the equator, or it is a small circle. Now, all the arcs, such as R, *e*, *a*, G, &c. intercepted between the parallel and the equator, must be equal, since the circle is parallel to the equator; and hence every point in this parallel, or every place on the earth through which it is supposed to pass, has the same latitude.

Latitnde is the same all over the earth, being constantly measured from the equator to the poles.

The longitude of a place is measured by the degrees of an arc of the equator, intercepted between some particular meridian, and the meridian passing through the place. Thus, suppose G to represent the particular meridian, and *m* to represent the place whose longitude is required; the longitude of *m* is measured by the arc *m a* of the equator, intercepted between *a*, the point where the meridian of G meets the equator, and *m* the point of the equator where it is cut by the meridian of the place *m*. The particular meridian from which we begin to reckon the degrees of longitude is called the *prime* or *first meridian*, and it is different in different countries.

The method of estimating the distances of places by longitudes and latitudes, is of considerable antiquity, and was employed by Eratosthenes, who first introduced a regular parallel of latitude, which began at the straits of Gibraltar, passed eastwards through the island of Rhodes to the mountains of India; all the intermediate places through which it passed being carefully noted. Soon after drawing this parallel through Rhodes, which was long considered with a degree of preference, Eratosthenes undertook to trace a meridian, passing through Rhodes and Alexandria, as far as Syene and Meroë. Pythias of Marseilles, according to Strabo, considering the island of Thule as the most western point of the then known world, began to count the longitnde from thence, while Marianus of Tyre placed their first meridian at the Fortunate islands, or the Canaries; but they did not determine which was the westermost of these islands, and consequently which ought to serve as a first meridian. Among the Arabians, Alfragan, Albategnus, Nassir Eddin, and Ulug Beg, also reckoned from the Fortunate islands; but Abulfeda began to reckon his longitude from a meridian 10° to the eastward of that of Ptolemy, probably because it passed through the western extremity of Africa, where, according to him, were situated the pillars of Hercules; or because it passed through Cadiz, which was at that time rendered famous by the conquests of the Moors in Spain.

When the Azores were discovered by the Portuguese in 1448, some geographers made use of the island of Tercera as the first meridian. Other geographers, at Bleau, father and son, placed the first meridian at the Peak of Teneriffe, a mountain so far elevated above the sea, that it may be easily known by navigators; while others have made the island of St Philip, one of the Cape de Verds, the first meridian, because they conceived this to be the place where the magnetic needle had no variation. For a long time it was customary to reckon the longitude in most countries from the isle of Ferro, one of the Canary isles; but it is now customary for each nation to reckon the longitude, either from the metropolis of the country, or from the national observatory situated near it. Thus in France, Paris is the first meridian, and in Great Britain, the Royal Observatory of Greenwich. As in several good maps, the isle of Ferro is still used as a first meridian, it may be proper to remark, that the observatory at Greenwich lies 17° 45′ to the east of Ferro. Hence it is very easy to reduce the longitude of Ferro to that of Greenwich; for if the longitude required be east, we have only to subtract 17° 45′ from the longitude of Ferro, and the remainder is the longitude east from London; on the other hand, if the place be west from Ferro, we obtain the longitude west from London by adding to that of Ferro 17° 45′. If the place lies between Ferro and London, its longitude from London will be obtained by subtracting its longitude east from Ferro from 17° 45′. It is evident that by the reverse of this method, we may reduce the longitude from London to that of Ferro.

62 Method of reducing longitudes to the same meridian.

In the diagram referred to above, if G represent the observatory of Greenwich, *a* will be the point from which we begin to reckon the degrees of longitnde, and all places situated to the east of *a*, snch as R, *m*, will have east longitude, while those situated to the west, as *n*, will have west longitude. In reckoning the longitude, we sometimes number the degrees only as far as 180°, but at other times they are numbered all round the equator from the point *a*; for instance 180°, till we come to *a* again; hence reckoning in the direction *a*, R, *m*, we should say that every place was in so many degrees east longitnde, while if we reckon in the direction *n*, E, we should say that all the places had so many degrees west longitude all round the equator. To accommodate the globes to both these modes of reckoning the longitude, the equator is usually divided both ways, in a continued series from 0 at the first meridian to 360°.

It is evident, that as the parallels of latitude become smaller as they approach the poles, the arcs of these parallels intercepted between the same two meridians will be also smaller as we proceed from the equator to the poles, though in fact they consist of the same absolute number of degrees. Hence it will be easy to see that a degree of longitude must be smaller towards the poles than at the equator, and must become gradually smaller and smaller till we arrive at the poles, where it will be equal to nothing. Thus the arc G *v*. contains the same number of degrees as the arc *a*, *m*, though the former arc is much smaller than the latter. As a degree of longitude is therefore different at every degree of latitude, it becomes necessary to ascertain the relative proportion between the two; and for this purpose the following table has been constructed, which shews the absolute measure of a degree of longitude in geographical miles and parts of a mile for every degree of latitude, taking the degree of longitude at the equator, equal to 60 geographical miles.

Table

TABLE I. *Shewing the length of a degree of longitude for every degree of latitude, in geographical miles.*

Lat.	Geo.miles	Lat.	Geo.miles.	Lat.	Geo.miles	Lat.	Geo.miles	Lat.	Geo.miles.	Lat.	Geo.miles.
1	59.96	16	57.60	31	51.43	46	41.68	61	29.04	76	14.51
2	59.94	17	57.30	32	50.88	47	41.00	62	28.17	77	13.50
3	59.92	18	57.04	33	50.32	48	40.15	63	27.24	78	12.48
4	59.86	19	56.73	34	49.74	49	39.36	64	26.30	79	11.45
5	59.77	20	56.38	35	49.15	50	38.57	65	25.36	80	10.42
6	59.67	21	56.00	36	48.54	51	37.73	66	24.41	81	9.38
7	59.56	22	55.63	37	47.92	52	37.00	67	23.45	82	8.35
8	59.40	23	55.23	38	47.28	53	36.18	68	22.48	83	7.32
9	59.20	24	54.81	39	46.62	54	35.26	69	21.51	84	6.28
10	59.08	25	54.38	40	46.00	55	34.41	70	20.52	85	5.23
11	58.89	26	54.00	41	45.28	56	33.55	71	19.54	86	4.18
12	58.68	27	53.44	42	44.95	57	32.67	72	18.55	87	3.14
13	58.46	28	53.00	43	43.88	58	31.79	73	17.54	88	2.09
14	58.22	29	52.48	44	43.16	59	30.90	74	16.53	89	1.05
15	58.00	30	51.96	45	42.43	60	30.00	75	15.52	90	0.00

As it is often more convenient to estimate degrees of longitude in English statute miles, we have added the following

TABLE II. *Shewing the length of a degree of longitude for every degree of latitude, in English statute miles.*

Lat.	Eng. miles	Lat.	Eng. miles.	Lat.	Eng. miles.	Lat.	Eng. miles.	Lat.	Eng. miles	Lat.	Eng. miles.
0	69.2000	16	66.5192	32	58.6851	48	46.3038	64	30.3352	80	12.0166
1	69.1896	17	66.1760	33	58.0360	49	45.3994	65	29.2453	81	10.8250
2	69.1578	18	65.8134	34	57.3696	50	44.4811	66	28.1464	82	9.6306
3	69.1052	19	65.4300	35	56.6852	51	43.5489	67	27.0385	83	8.4334
4	69.0312	20	65.0265	36	55.9842	52	42.6037	68	26.9230	84	7.2335
5	68.9363	21	64.6037	37	55.2659	53	41.6453	69	24.7992	85	6.0315
6	68.8208	22	64.1609	38	54.5303	54	40.6751	70	23.6678	86	4.8274
7	68.6845	23	63.6986	39	53.7788	55	39.6917	71	22.5294	87	3.6219
8	68.5267	24	63.2177	40	53.0100	56	38.6959	72	21.3842	88	2.4151
9	68.3481	25	62.7167	41	52.2259	57	37.6891	73	20.2320	89	1.2075
10	68.1489	26	62.1963	42	51.4253	58	36.6705	74	19.0743	90	0.0000
11	67.9288	27	61.6579	43	50.6094	59	35.6408	75	17.9103		
12	67.6880	28	61.1001	44	49.7783	60	34.6000	76	16.7409		
13	67.4264	29	60.5237	45	48.9313	61	33.5489	77	15.5665		
14	67.1448	30	59.9293	46	48.0705	62	32.4873	78	14.3874		
15	66.8424	31	59.3162	47	47.1944	63	31.4161	79	13.2041		

63 Method of reducing degrees to miles, and v. v.

Hence it appears that the degrees of latitude are all equal, and that a degree of longitude at the equator is equal to a degree of latitude, as each is $\frac{1}{360}$th of a great circle. In the second of the above tables, a degree of longitude at the equator is estimated at 69.2 English miles, or about $69\frac{1}{4}$. The length of a degree in miles is usually estimated at $69\frac{1}{2}$, but this is too much. Hence, to reduce degrees of latitude, and those of longitude near the equator, to English miles, it is necessary to multiply them by 69.2, or, if great accuracy is not required, by 70.

64 Problems on latitude and longitude.

PROBLEM I. *To find the latitude and longitude of a given place.*

Bring the place below the graduated edge of the *brazen meridian*, and the degree of the meridian that lies immediately over the place is its *latitude*. Observe where the meridian cuts the equator, and that degree will be the *longitude* of the place.

Example. To find the latitude and longitude of Edinburgh.—Bringing Edinburgh below the meridian, we find over it nearly the 56th degree of north latitude ($55^{\circ}\ 58'$), and the point where the meridian cuts the equator is nearly $3\frac{1}{4}$ ($3^{\circ}\ 12'$ W. Long.) degrees west from London.

N. B. The longitude and latitude of places cannot be ascertained exactly by the globes, as these are not calculated to show the fractional parts of a degree; but they may be found with sufficient correctness for ordinary purposes.

COROLLARY I. The difference of latitude and longitude

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gitude between two places is found by subtracting the less from the greater, if they lie the same way, i. e. north or south, east or west; or by adding the two together, if they lie in a different direction.

COR. 2. Those places that have the same latitude with any given place are found, by bringing the given place to the meridian, and observing what places pass under the same degree, while the globe is turned round.

COR. 3. Those places which have the same longitude with a given place, are found by bringing the place to the meridian, and observing what other places lie under the graduated edge, while the globe is at rest.

PROBLEM II. *The latitude and longitude of a place being given, to find the place itself on the globe.*

Turn the globe till the given longitude comes under the brazen meridian; then mark the given latitude on the meridian, and immediately below it is the place required.

Example. What place is situated in 48° 23′ N. Lat. and 4° 29′ E. Long. from Greenwich? *Ans.* Brest in France.

Computation of longitude in time.

As the sun, in his apparent motion round the earth, measures a great circle in about 24 hours, or in one hour passes over $\frac{1}{24}$th of such circle, or 15°; it is evident that all places which lie 15° west of any meridian, must have noon or any other time of the day, an hour *later* than those situated under that meridian; and that all places which lie 15° *east* of any meridian, must have the same times of the day an hour *sooner*. Hence, because the meridians drawn on the globe make a difference of an hour each in the time of places, they are sometimes called hour-circles; and the longitude of places is sometimes reckoned in *time* as well as in *degrees*.

Degrees of longitude are reduced to hours and minutes, and *v. v.* by allowing an hour for every 15°, and four minutes for every degree.

Horary circles.

Though the meridians on the globe are sometimes called *horary circles*, this name is generally confined to a small brass circle, which is adapted to one or each pole, and graduated into twice twelve hours; so that an index fixed to the axis, or the meridian, points out the several hours of day and night as the globe revolves.

In globes of the old construction the hour circles are fixed on the outside of the meridian, but this prevents the meridian from being moved quite round, which is required in some problems.

Mr Joseph Harris, formerly assay-master of the mint, contrived an ingenious method of remedying this inconvenience. He placed two horary circles between the meridian and the globe, one at each pole, and they were fixed tightly between two brass rollers, placed about the axis, so that when the globe was turned, they were carried round with it, while the edge of the brazen meridian served as an index to cut the horary divisions. A globe, thus furnished, serves universally and readily for performing problems in both northern and southern latitudes; and also in places near the equator; whereas, in globes of the old construction, the axis and horary circle prevent the brazen meridian from being moved quite round in the horizon.

The construction of the hour circles was rendered somewhat more simple by Mr G. Wright of London. In his globes, there are engraved two hour circles, one at each pole, on the map of the globe, each circle being divided into a double set of 12 hours, as in the usual hour circles; but here the hours are numbered both to the right and left. (See fig. 4.). The hour hand, or index, is placed below the brazen meridian, in such a way that it may be moved at pleasure to any required part of the circle, and remain there sufficiently steady during the revolution of the globe on its axis, being entirely independent of the pole. In this manner the motion of the globe round its axis, carrying the hour circle, the time is pointed out by the stationary index.

In the globes constructed by the late Mr George Adams, the equator is made to answer the purpose of an hour circle, by means of a semicircular wire placed in its plane, (see Q F, fig. 5.) and carrying two indices F, one on the eastern, the other on the western, side of the brazen meridian. The method of using these indices will be shewn presently. In these globes the equator is also marked with twice 12 hours, which increase from east to west, the hours to the west of the first 12 being afternoon hours.

67
Problems relating to time.

PROBLEM III. *The hour at any place being given, to find what hour it is at any other place.*

a, By the ordinary globes.

Bring the place at which the hour is given to the meridian, and set the index of the hour circle to the given hour. Then turn the globe till the other place comes under the meridian, and the index will now point to the hour required.

N. B. Where there is no index, the edge of the meridian will in both cases point out the hour.

b, By Adams's globes.

The steps are here the reverse of the former. Bring the place at which the time is required to the brazen meridian, and set the index to the given hour. Then turn the globe till the other place comes below the meridian, and the index will shew the time required.

N. B. In the ordinary globes, where the hour circle is usually marked with two sets of figures, it is proper, in performing this problem, to make use of that set which increases towards the right hand, observing that whichever XII. is fixed on for noon, the hours to the right or *east* of this are hours P. M. and those to the left or *west* are hours A. M. On Adams's globes the contrary of this takes place, from the hours being marked on the equator. They increase from east to west, and, of course, those to the east of XII. are morning hours, and those to the west of it afternoon hours.

Example 1. When it is noon at London, what hour is it in the Society isles? *Ans.* Two A. M.

Ex. 2. When it is 3 P. M. at Edinburgh, what hour is it at Delhi in Hindoostan? *Ans.* Thirty minutes past eight P. M.

Problem IV. *Having the hour at any place given, to find all those places where it is noon.*

a, By the ordinary globes.

Bring the given place to the meridian, and set the index to the given hour. Then turn the globe till the index point to 12 at noon, and the places then under the meridian are those required.

b, By Adams's globes.

Bring the given place to the meridian, and set the index to 12 at noon. Then turn the globe till the index shall point to the given hour; and all the places then under the meridian have noon at that time.

Ex. 1. It is now 30 min. past 10 A. M. at Edinburgh; In what places is it noon? *Ans.* Near Stockholm; at Dantzic, Breslaw, Presburg, Vienna, Posega, Ragusa, Tarento, and the Cape of Good Hope.

Ex. It is now midnight at London; Where is it noon? *Ans.* In the north-east parts of Asia, in the middle of Fox isles; at the Friendly isles (nearly), and at the east cape of New Zealand.

From the different situation of places with respect to latitude and longitude, the inhabitants of these places received from the ancients denominations that are still retained.

68 Antœci. Thus, those places which have the same longitude, or are situated under the same meridian, but are in opposite latitudes, the one lying as many degrees to the north of the equator as the other lies to the south of it, are said to be ANTOECI to each other. From this definition it is evident, that those places situated under the equator have no *antœci.*

The appearances arising from the changes of the heavenly bodies are different in the opposite places. Thus, 1. The days of the one are equal to the nights of the other, and *vice versa;* but they have noon, midnight, and all the other hours at the same time. 2. They have contrary seasons at the same time: when it is summer at one place it is winter at the other, and so of spring and autumn. 3. The stars that never set at one place, never rise at the other, and *vice versa.*

69 Periœci. Again, those places that have the same latitude, or are under the same parallel, but are in opposite longitudes, i. e. lie under opposite arcs of the same meridional circle, or 180° from each other, are said to be PERIOECI to each other. Those places which may be situated at the poles, have evidently no *periœci.*

The celestial appearances to the periœci are as follow. 1. The length of the day or night is the same to both places; but the hours, though distinguished by the same numbers, are contrary; noon at the one being midnight at the other; and any hour in the forenoon at the one being the same of the afternoon to the other. 2. Both places have the same seasons of the year at the same time. 3. The same stars that never rise or set to one place, also never rise or set to the other. 4. The heavenly bodies rise in the same point of the horizon at both places, and continue for the same interval above or below it.

70 Antipodes. Lastly, Those places which are situated directly opposite to each other, by a distance equal to the diameter of the earth, are said to be ANTIPODES to each other. If we conceive a line through the centre of the earth, and terminated in two points of its surface, these extreme points are antipodes to each other. Thus, the city of Lima in Peru is nearly the antipodes to Siam in the East Indies; and Pekin in China has for its antipodes Buenos Ayres in South America. These places are always in opposite longitudes, and (except under the equator) in opposite latitudes.

The celestial appearances to the antipodes are these. 1. The hours are contrary, as to the periœci. 2. The days of the one are of the same length with the nights of the other; hence the longest day to one is the shortest to the other, and *vice versa.* 3. They have contrary seasons at the same time. 4. Those stars which, at one place are always above the horizon, are, to the other, always below it. 5. When the heavenly bodies are rising at one place, they are setting at its *antipodes*, and *vice versa.* For various opinions respecting the antipodes, see the article ANTIPODES.

The antipodes of any places are the periœci to the antœci of that place; and the antœci to their periœci. This will account for the method presently described of finding the antipodes on the globe.

Problem V. *To find the* antœci *to any given place.* 71 Problem.

Bring the given place to the meridian, and thus ascertain its latitude. Then count from the equator towards the opposite pole as many degrees as are equal to the latitude of the place; and the point where this reckoning ends is the place required.

Ex. 1. Where are the *antœci* to the Cape of Good Hope? *Ans.* At Malta nearly.

Ex. 2. What people are the *antœci* to the inhabitants of Quebec in North America? *Ans.* The inhabitants of Patagonia in South America.

Problem VI. *To find the* periœci *of any given place.*

Bring the given place to the brazen meridian, and set the horary index to the upper XII. Then turn the globe till the index point to the lower XII. The place which is then below the meridian in the same latitude with that of the given place, is the situation required.

Ex. 1. Where are situated the *periœci* of Newcastle upon Tyne? *Ans.* In the Aleouski or Fox islands.

Ex. 2. Required the periœci to California in North America. *Ans.* Near the mouth of the river Indus.

Problem VII. *To find the* antipodes *to any given place.*

Find the *antœci* of the given place (by Problem V.) and then find the *periœci* of the latter (by Problem VI.). This last is the place required.

Ex. 1. It is required to find the antipodes of London. *Ans.* The latitude of London is 51° 31′ N. the antœci to this, or 51° 31′ S. on the prime meridian, is in the south Atlantic ocean; the periœci to this is in 180° W. Long. and 51° 31′ S. Lat. a little to the south of the islands of New Zealand. The inhabitants of the southern island of New Zealand are therefore the nearest antipodes to London.

Several other circles besides those which we have mentioned are described on the artificial globe, and are supposed to be drawn on the earth. These we shall now proceed to describe, and explain their geographical uses.

The

The Ecliptic. The *Ecliptic* (ASTRONOMY, N° 43.) is a great circle drawn on the globe, crossing the equator obliquely in two points, called the equinoctial points. (ASTRONOMY, N° 44.). This circle extends on each side of the equator to the latitude of 23° 28′, and is divided into 12 great parts corresponding to the 12 signs of the zodiac (see ASTRONOMY, N° 52.), and marked with their characters, and each sign is subdivided into 30 degrees. The ecliptic has also its poles, which are two points that are distant 90° every way from the circle on each side. As the ecliptic declines from the equator 23° 28′, its poles are consequently distant from those of the equator, or of the globe, by the same measure. This circle properly belongs to the celestial globe, but as it is extremely useful in performing many geographical problems, it is always drawn on both globes, and requires to be noticed here, since it determines the position of several of the circles which we are about to mention.

Tropics. Through those two points of the ecliptic, where it is at the greatest distance from the equator, there are drawn on the globes two circles parallel to the equator, called *tropics.* That in the northern hemisphere is called the *Tropic of Cancer*, as it passes through the sign Cancer; and, for a similar reason, that which is in the southern hemisphere is called the *Tropic of Capricorn.* The two points through which they are drawn are called *solstitial points.* The imaginary line which corresponds to the tropic of Cancer on the earth passes from near Mount Atlas on the western coast of Africa, past Syene in Ethiopia: thence, over the Red sea, it passes to Mount Sinai, by Mecca the city of Mahomet, across Arabia Felix to the extremity of Persia, the East Indies, China, over the Pacific ocean to Mexico, and the island of Cuba. The tropic of Capricorn takes a much less interesting course, passing through the country of the Hottentots, across Brazil, to Paraguay and Peru.

Polar circles. If the poles of the ecliptic be supposed to revolve about the poles of the earth, they will describe two circles parallel to the equator, and 23° 28′ distant from it. Two such circles are drawn on the globes, and are called *Polar Circles*, that in the north being called the *Arctic Polar Circle*, or merely the *Arctic Circle*, while that in the south is called the *Antarctic Polar Circle*, or *Antarctic Circle.*

Both the tropics and the polar circles are marked on the globes by dotted lines, to distinguish them from the other parallels.

75 Colures. The meridional circles that pass through the equinoctial and solstitial points are called *Colures;* the former being called the *Equinoctial* and the latter the *Solstitial Colure.*

For an account of the variety of day and night in different parts of the globe, see ASTRONOMY, Part II. ch. i. sect. 2.

76 Zones. By means of the tropics and polar circles, the earth is supposed to be divided into five spaces, to which the ancients gave the name of *Zones*, or *Belts.* Thus the space included between the two tropics was called the *Torrid Zone*, because it was supposed to be so much heated or *roasted* by the vertical sun, which there prevails, as to be uninhabitable. The ancient terms are still occasionally used, but the countries between the tropics are now more commonly called the *Intratropical Regions.* The two spaces included between each tropic and its corresponding polar circle were called *Temperate Zones*, and were distinguished according to their position into *Northern* and *Southern Temperate Zones.* Lastly, The spaces between the polar circles and the poles were called the northern and southern *Frigid Zones*, and were supposed uninhabitable from excessive cold. These last are usually denominated the *Polar Regions.*

The countries lying between the tropics are the greater part of Africa, the southern parts of Arabia, the eastern and western peninsulas of India; all those clusters of islands lying between the southern continent of Asia and New Holland, called the Sunda, Molucca, Philippine, Pelew, Ladrone, and Carolina islands; the northern half of New Holland, New Guinea, New Britain; most of the groups of islands in the Pacific ocean, as the New Hebrides, New Caledonia, the Friendly and Society isles, the Sandwich and Navigators isles; the West India islands; the greater part of South America; the Cape de Verd islands, and those of St Helena, Ascension, St Matthew, and St Thomas. See the map of the world in Plate CCXXXVI. or the plain chart in Plate CCXXXVII. 77 Countries between the tropics.

All places situated between the tropics have the sun vertical twice in the year, at noon; but the time of the year when this happens is different in the different latitudes; at the equator, the sun is vertical when he is in the equinoctial points, or when he has no declination. The inhabitants of the other *intratropical regions* have the sun vertical when his declination is equal to their latitude, and on the same side of the equator. Thus, the inhabitants of New Caledonia, about 20° S. Lat. have the sun vertical when his declination is 20° S. To illustrate this, it will be sufficient to observe that, as the ecliptic is that circle in the heavens in which the sun is supposed to move, the sun's rays are perpendicular successively to every point of the earth which lies below that point of the ecliptic in which the sun happens to be, and he will therefore be vertical to all the places through which the ecliptic (continued to the earth) passes successively.

The inhabitants of the torrid zone have their shadows at noon day sometimes to the south, i. e. when the sun's declination is north, and sometimes to the north, i. e. when the sun's declination is south. They were therefore called by the ancients *Amphiscii*, from αμφι, *about*, and σκια, *shadow.* See AMPHISCII and ASCII. 78 Amphiscii.

In the north temperate zone are situated the whole of Europe except Lapland; Barbary, and part of Egypt, in Africa; nearly the whole continent of Asia; a great part of North America; the Azores, and the Canary and Madeira islands. 79 Countries in the temperate zone.

In the south temperate zone lie the southern part of Africa, the southern half of New Holland, New Zealand, and the southern part of South America.

In the temperate zones the sun is never vertical, and the length of the days and nights differs much more than in the torrid zone.

The inhabitants of these regions have their shadows at noon always in the same direction; those in the north temperate zone having them directed to the north, 80 Heteroscii.

north, and those in the southern zone, towards the south. They were hence called by the ancients *Heteroscii*. See HETEROSCII.

81
Countries in the frigid zones.

The countries that are situated in the northern frigid zone, are Lapland, Spitzbergen, Nova Zembla, the northern parts of Asia and America, and part of Greenland.

No land has yet been discovered within the south polar circle, though it was long supposed that a large continent was situated there, which was called *Terra Australis Incognita*. Our celebrated navigator Cook made many attempts to penetrate the icy fields which abound in these seas, in search of this imaginary continent, but without success, he having penetrated no farther than 72°. See COOK's *Discoveries*, N° 49. and 71.

Within the polar circles the sun does not always rise or set every 24 hours as in the other zones; but for a certain number of days in summer he never sets, and for a certain number of days in winter he never rises; the number of days during which the sun is present or absent increasing from the polar circles to the poles, so that at the poles he never sets for six months, nor rises during a like period.

82
Periscii.

When the sun continues above the horizon more than 24 hours, the inhabitants of the polar regions have their shadows cast all around them; and hence they have been called *Periscii*. See PERISCII.

83
Climates.

The ancients did not employ regular parallels of latitude, but they divided the spaces between the equator and the poles into small zones corresponding to the length of the longest day in each division. To these subdivisions they gave the name of climates, the situation and extent of which they determined in the following manner. As the day at the equator is exactly 12 hours throughout the year, but the longest day increases as we approach the poles, the ancients made the first climate to end at that latitude where the longest day was $12\frac{1}{2}$ hours, which by observation they found to be in the latitude of 8° 25′. The second climate extended to latitude 16° 25′, where the longest day is 13 hours, and thus a new climate extended, so as to divide the whole tract between the equator and the poles into 24 climates, in each of which the longest day was longer by half an hour than in that nearer the equator. The space between the polar circles and the poles they divided into six climates, in each of which the length of the longest day increased by a month, till at the poles it was six months long. Hence, the 24 climates between the equator and the polar circles are called *Hour Climates*; and the six between the polar circles and the poles are called *Month Climates*. For further particulars respecting this ancient division of the globe, and a table of the climates by Ricciolus, see CLIMATE. As the table given under that article is calculated only for the middle of each climate, and neither mentions the breadth of each, nor is extended to all the climates, we shall here subjoin one in which are given the latitude at which each climate terminates, its breadth in degrees, and the length of the longest day at the parallel terminating each.

Table of climates.

HOUR CLIMATES.

Climates.	Latitude.		Breadth		Longest Days	
I	8°	25′	8°	25′	12^h	30^m
II	16	25	8		13	
III	23	50	7	25	13	30
IV	30	25	6	30	14	
V	36	28	6	8	14	30
VI	41	22	4	54	15	
VII	45	29	4	7	15	30
VIII	49	1	3	32	16	
IX	52		2	57	16	30
X	54	27	2	29	17	
XI	56	37	2	10	17	30
XII	58	29	1	58	18	
XIII	59	38	1	29	18	30
XIV	61	18	1	20	19	
XV	62	25	1	7	19	30
XVI	63	22	0	52	20	
XVII	64	6	0	44	20	30
XVIII	64	49	0	43	21	
XIX	65	21	0	32	21	30
XX	65	45	0	26	22	
XXI	66	6	0	19	22	30
XXII	66	20	0	14	23	
XXIII	66	28	0	8	23	30
XXIV	66	31	0	3	24	

MONTH CLIMATES.

Climates.	Latitude.		Breadth.		Longest Day.
I	67°	21′		50′	1 month.
II	69	48	2°	27	2
III	73	37	3	49	3
IV	78	30	5	8	4
V	84	5	5	35	5
VI	90		5	55	6

Places in the northern climates.

As the division of the globe into climates, though now almost disused, is of service in shewing the length of the longest day in different countries, we shall here enumerate the principal places in each northern climate, these being best known and most interesting.

I. The Gold and Silver Coasts in Africa; Malacca in the East Indies; and Cayenne and Surinam in South America.

II. Abyssinia in Africa; Siam, Madras, and Pondicherry, in the East Indies; the isthmus of Darien; Tobago, the Grenades, St Vincent, and Barbadoes, in the West Indies.

III. Mecca in Arabia; Bombay, part of Bengal, in the East Indies; Canton in China; Mexico and the bay of Campeachy, in North America; and Jamaica, Hispaniola, St Christopher's, Antigua, Martinique, and Guadaloupe, in the West Indies.

IV.

IV. Egypt and the Canaries in Africa; Delhi, the capital of the Mogul empire, in Asia; most of the gulf of Mexico, and East Florida, in North America; and the Havannah in the West Indies.

V. Gibraltar; part of the Mediterranean sea; the Barbary coast in Africa; Jerusalem, Ispahan, capital of Persia, and Nankin, in China, in Asia; and California, New Mexico, West Florida, Georgia, and the Carolinas in North America.

VI. In Europe, Lisbon, Madrid, the islands of Minorca and Sardinia, and part of Greece or the Morea; in Asia, Asia Minor, part of the Caspian sea, Samarcand, Pekin, Corea, and Japan; and in North America, Maryland, Philadelphia, and Williamsburgh in Virginia.

VII. In Europe, the northern provinces of Spain, the southern provinces of France, Turin, Genoa, Rome, and Constantinople; in Asia, the rest of the Caspian, and part of Tartary; and in North America, Boston and New York.

VIII. Paris and Vienna, in Europe; and New Scotland, Newfoundland, and Canada, in North America.

IX. London, Flanders, Prague, Dresden, Cracow, in Europe; the southern provinces of Russia, and the middle of Tartary in Asia; and the northern part of Newfoundland, in America.

X. Dublin, York, Holland, Hanover, Warsaw; the west of Tartary, Labrador, and New South Wales, in North America.

XI. Newcastle, Edinburgh, Copenhagen, and Moscow.

XII. Southern part of Sweden; and Tobolsk in Siberia.

XIII. Stockholm; and the Orkney isles.

XIV. Bergen in Norway, and St Petersburgh.

XV. Hudson's Straits in North America.

XVI. Most of Siberia; and the southern parts of Greenland.

XVII. Drontheim in Norway.

XVIII. Part of Finland in the Russian empire.

XIX. Archangel on the White sea.

XX. Iceland.

XXI. Northern parts of Russia in Europe, and Siberia in Asia.

XXII. New North Wales, in North America.

XXIII. Davis's Straits, in North America.

XXIV. Samoieda in Asia.

XXV. Northern parts of Lapland.

XXVI. West Greenland.

XXVII. Southern part of Nova Zembla.

XXVIII. Northern part of Nova Zembla.

XXIX. Spitzbergen.

XXX. Unknown.

The only parts of the terrestrial globe that we have yet to describe and illustrate are the *Quadrant of Altitude*, and the *Wooden Horizon*; and these it is necessary to explain, before we proceed to consider the remaining problems performed with this globe.

86 Quadrant of altitude.

The *Quadrant of Altitude* is a thin flexible slip of brass, graduated into 90°, and made to fix on any part of the brazen meridian by means of a nut and screw. Round this nut it moves on a pivot, and by its flexibility may be applied close to the surface of the globe. The quadrant of altitude is used to measure the distances of places from each other on the terrestrial globe, and to ascertain the altitudes of the sun, stars, &c. on the celestial globe.

To measure the distance between two places on the globe, nothing more is required than to stretch the graduated edge of the quadrant between them, and mark the number of degrees intercepted. These reduced to geographical, or to English miles (by N° 63.) give the absolute distance between the places. It is most convenient to bring one of the places to the zenith, which may be done by rectifying the globe for the latitude of that place as immediately to be explained, and then to stretch the quadrant to the other place, the distance marked, subtracted from 90°, gives the true distance in degrees. If the distance required be greater than 90°, it is proper to rectify the globe for the *antipodes* of the given places, and add the distance observed to 90°: the sum is the distance required.

It has been very generally stated that the bearing of one of the places from the other may be found by observing, on the wooden horizon, in what point of the compass the quadrant of altitude, thus fixed in the zenith, cuts the horizon. This is considered by Mr Pattcson as a mistake: "For (says he) supposing one of the places to lie due east of the other, they are in the same parallel of latitude, and consequently it is impossible that the prime vertical of either of them (that is, a circle cutting the east and wests points of the horizon), should pass through the other, unless they both lay under the equator. A line shewing the bearings of places is called a rhumb line. The lines of north and south on the globe, being meridians, and those of east and west being parallels of latitude, are consequently circles; but all the remaining rhumbs are a kind of spiral lines."

87 Wooden horizon.

The globes are supported by a wooden frame ending above in a broad flat margin, on which is pasted a paper marked with several graduated circles. This broad margin is called the wooden horizon, and represents the rational horizon of the earth, or the limit between the visible and the invisible hemispheres. On the paper with which the wooden horizon is covered, are drawn four concentric circles. The innermost of these is divided into 360 degrees, divided into four quadrants. The second circle is marked with the points of the compass, i. e. the four cardinal points, east, west, north, and south (D), each being subdivided into eight parts or rhumbs, (see COMPASS). The circle next to that just mentioned contains the twelve signs of the zodiac, distinguished by their proper names and characters; and

(D) The cardinal points of the compass are thus determined. The two points in which the meridian of any place when produced so as to pass through the nearest pole, cuts the horizon, (using this in an astronomical sense, see ASTRONOMY,) are the north and south points; the former being that point where the meridian first cuts the horizon in the *northern* hemisphere, and the south, that where it first meets the horizon in the southern hemisphere. Again, the two points where a great circle, passing through the zenith at right angles with the meridian, (and called

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and each sign is divided into 30 degrees. The last circle shews the months and days corresponding to each sign.

This wooden ring can represent the rational horizon of any place marked on the terrestrial globe only, when that place is situated in the zenith; and the method of bringing the place into this situation is called *rectifying the globe.*

88 To rectify the globe.

PROBLEM VIII. *To rectify the globe according to the latitude of any place.*

Find the latitude of the place, (by Problem I.) and see whether it be north or south. Then elevate the pole of the globe which is in the same hemisphere with the latitude, as far above the wooden horizon as is equal to the latitude; bring the given place to the brazen meridian, and it will be in the zenith.

Example. To rectify the globe for the latitude of Edinburgh. The latitude of Edinburgh is 55° 58′ N. therefore raise the *north* pole 55° 58′ above the horizon, and bring Edinburgh below the brass meridian.

It is for the purpose of more easily rectifying the globe, that one half of the brazen meridian is graduated from the poles to the equator; as, where this is not done, it is necessary to take the complement of the latitude, or the difference between it and 90°, which in some cases requires a calculation.

The place being brought below the meridian, when the pole is elevated to the proper degree, it is evidently in the zenith, or 90° distant every way from the horizon. Thus, in the above example, if we count the degrees from that part of the meridian below which Edinburgh is situated, we shall find that they amount to 90° each way; for counting from Edinburgh along the meridian to the north pole, we have 34° 2′; which added to 55° 58′, the elevation of the poles, gives 90° on that side. Again, counting from the same point of the meridian towards the southern part of the horizon, we have 55° 58′, as far as the equator, and 34° 2′ from thence to the horizon, making, as before, 90°, and as the graduated edge of the meridian is 90° both from the eastern and western side of the horizon, Edinburgh, in this situation of the globe, is in the zenith.

89 Oblique sphere.

When either of the poles of the globe is thus elevated above the horizon, so as not to be in the zenith, the globe is said to be in the position of an *oblique sphere*, in which the equator and all its parallels are unequally divided by the horizon. This is the most common situation of the earth, or it is the situation which it has with respect to all its inhabitants, except those at the equator and the poles. To the inhabitants of an oblique sphere the pole of their hemisphere is elevated above the horizon as many degrees as are equal to their latitude, and the opposite pole is depressed as much below the horizon, so that the stars only at the former are seen; the sun and all the heavenly bodies rise and set obliquely, the seasons are variable, and the days and nights unequal. This position of the sphere is represented at fig. 6. where the equator EQ, and the parallels cut the horizon HO obliquely, and the axis PS is inclined to it. Hence this position is called *oblique.*

90 Right sphere.

If the globe is placed in such a position that any point of the equator is in the zenith, it is said to be in the position of a *right* or *direct sphere*, because the equator and its parallels are vertical, or over the horizon at right angles. This position is seen at fig. 7. where the axis PS is in the plane of the horizon, and the equator EQ is in a plane perpendicular to it. The inhabitants of such a sphere, which are the inhabitants of the earth below the line, have no elevation of the poles, and consequently no latitude: they can see the stars at both poles, all the stars rise, culminate, and set to them; and the sun always moves in a curve at right angles to their horizon, and is an equal number of hours above and below it, making the days and nights always equal.

91 Parallel sphere.

If the globe be so placed that one of the poles is in the zenith, and consequently the other in the nadir, it is in the position of a *parallel sphere;* so called because the equator EQ (fig. 8.) coincides with the horizon, and the parallels are of course parallel to it; while all the meridians cut the horizon at right angles. The inhabitants of a sphere, in this position, have the greatest possible latitude; the stars, which are situated in the hemisphere to which the inhabitants belong, never set, but describe circles all around; while those of the contrary hemisphere never rise: the sun is above the horizon for six months, during which it is day, and is below the horizon for an equal interval, when it is night.

The wooden horizon is a necessary part of the apparatus of both globes; but it has been shewn, that in the terrestrial globe, it can represent the rational horizon of a place, only when the globe is rectified for the latitude of that place. In the celestial globe, it represents the rational horizon in all positions.

In Adams's globes there is a thin brass semicircle NHS (fig. 5.) that is moveable about the poles, and has a small thin circle N sliding on it. This semicircle is graduated into two quadrants, the degrees of which are marked both ways from the equator to the poles in the terrestrial globe: this semicircle represents a moveable meridian; and the small sliding circle, which is marked with a few of the points of the compass, is called a *visible horizon*, the use of which will appear presently.

Before we proceed to the remaining problems on the terrestrial globe, it will be proper to take notice of some geographical principles that are connected with the horizon.

It is evident, that the extent of the sensible horizon of an observer depends on the height of his eye above the level surface of the earth. An eye placed on the surface of the earth sees scarcely any thing around it; but if it is elevated above that surface, it sees farther in proportion to its elevation, provided always that its view is not obstructed by intervening objects. Thus, in an extensive plain, the eye can see farther, if elevated to

called the *prime vertical*) cuts the horizon, are the east and west points; the former being on the *left* hand of a person facing the sun at noonday, while the latter is on his *right* hand.

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to a proper height, than it can from the same height in a town or among hills; and, at sea, where the surface is perfectly equal, the view is in proportion to the height of the eye. It becomes an interesting problem to ascertain the extent of the visible horizon, or the distance to which a person can see at any given height of the eye; as, when this is known, we can calculate pretty accurately the distance of an object seen from such a height, as land seen from the topmast of a ship at sea.

For solving this problem, it must be remarked, that the distance of an observer from the boundary of the horizon, or from a distant object, is different when measured along the surface of the earth, and when measured in a direct line. To illustrate this, let HDN (fig. 9.) represent a section of the earth, of which C is the centre, and let D be the situation of an observer, whose eye is elevated to B. The lines BA, BE, tangents to the curve at H and E, represent the limit of the visible horizon, or the radii of the circle circumscribing vision. If the eye were elevated still higher, as to G, it is evident, that the extent of the visible horizon will be increased, being now represented by the tangent GF. The length of the tangent BA, or GF, is easily found by plane trigonometry (E).

93 Horizon of the sea.

It was remarked above, that the visible horizon is most distinct at sea, from the absence of those objects which obstruct vision on land. Hence the sensible horizon is sometimes called the horizon of the sea, and this may be observed by looking through the sights of a quadrant at the most distant part of the sea. In making this observation, the visual rays BA, or GF, by reason of the spherical surface of the sea, always extend a little below the true sensible horizon SS, and consequently below the rational horizon HN, which is parallel to it. Hence the quadrant shews the depression of the horizon of the sea lower than it really is; and it is obvious from the figure, that the higher the eye is situated, the greater must be this depression. Thus, the depression, when the eye is at G, marked by GF, is evidently much greater than that marked by BE, when the eye is at B. The depression of the horizon of the sea is not always the same, though there be no variation in the height of the eye; but the difference in this case is very small, amounting only to a few seconds, and is owing to a difference of the degree of refraction in the atmosphere. Were there no refraction, the visual ray would be BE (when the eye is at B), and E would be the most distant point; but, by reason of the refraction, a point on the surface of the earth beyond E, as F, may be seen by an eye situated no higher than B; and if the refraction were still greater, a still more distant point might be observed.

94 Difference between the apparent and true level.

It will be necessary here to anticipate a few remarks respecting the difference between the apparent and true levels; a subject that will be more fully discussed under LEVELLING. Two or more places are on a true level, when they are equally distant from the centre of the earth, and one place is higher than another, or above the true level, when it is farther from the centre of the earth. A line that is equally distant in all its points from the centre, is called the line of true level, and it is evident that this line must be curved: and either make part of the earth's surface, or be concentrical with it. Thus the line DAO, which has all its points, D, A, O, equally distant from the centre C, is the line of true level. But the line of sight DMP, as given by the operation of a level, is a straight line, which is a tangent to the earth's surface at D, always rising higher above the true line of level, according as it extends to a greater distance. This straight line is called the line of apparent level. Thus MA is the height of the apparent level above the true at the distance DA, and OP is the excess of the apparent above the true level, at the distance DO.

The following table was constructed by Cassini, for the purpose of shewing the excess of the apparent above the true level at various distances from the point of observation. It consists of three columns, in the first of which the distance of the observed object from the place of observation is given, from one second to 60 minutes, or a degree. In the second is given the length of the arc measured on a great circle of the earth, that corresponds to the observed distance, in feet and inches; and in the third is given the height of the apparent above the true level in feet and inches, corresponding to each observed and real distance of the object.

(E) In the right-angled triangle ACB (fig. 9.), the length of CB is given, supposing the height of the eye BD to be 6 feet; for adding 6 feet to 19,943,400 feet, the length of the semidiameter of the earth, we have 19,943,406 feet for the length of BC. Then, making the hypothenuse CB radius, we shall have, As radius to the sine of the angle BCA, so is CB to BA; and this will be nearly the same as the arc DA. Again, without finding the quantity of the angle at C, BA may be found, by considering that BA^2 is equal to the difference of the squares of CB and CA, i. e. $BA^2=CB^2-CA^2=(CB+CA)\times(CB-CA)=\overline{CB+CA}$ into BD; and hence $BA=\sqrt{(CB+CA)\times BD}$.

To illustrate the last in numbers, we have CB=19,943,406 feet, and CA=19,943,400 feet. Then, to find BA, we have $\overline{19,943,406+19,943,400}$ (=39,886,806) × 19,943,406—19,943,400 (=6) = 239,320,836; whence $BA=\sqrt{239,320,836}=15470$ feet nearly, or about three miles.

The distance, to which a person can see, is found to vary as the square root of the altitude of the eye. To find a general expression for this quantity,

let a be the altitude of the eye in feet,
d the distance at that altitude in miles;

then we have $\sqrt{6}:\sqrt{a}=3:d=\frac{3}{\sqrt{6}}\times\sqrt{a}=1.2247\times\sqrt{a}$. Hence, we deduce this general rule: *Multiply the square root of the height of the eye in feet by 1.2247, and the product will be the distance to which we can see from*

Seconds.	Feet.	Inch.	Inch.
1	101	6.8	
2	203	1.6	
3	304	8.4	
4	406	3.2	
5	507	10.0	0.074
6	609	4.8	
7	710	11.6	
8	812	6.4	
9	914	1.2	
10	1015	8.0	0.296
11	1117	2.8	
12	1218	9.6	
13	1320	4.4	
14	1421	11.2	
15	1523	6.0	
16	1625	0.8	
17	1726	7.6	
18	1828	2.4	
19	1929	9.2	
20	2031	4.0	1.186
21	2132	10.8	
22	2234	5.6	
23	2336	0.4	
24	2437	7.2	
25	2539	2.0	
26	2640	8.8	
27	2742	3.6	
28	2843	10.4	
29	2945	5.2	
30	3047	0.0	2.670
31	3148	6.8	
32	3250	1.6	
33	3351	8.4	
34	3453	3.2	
35	3554	10.0	
36	3656	4.8	
37	3757	11.6	
38	3859	6.4	
39	3961	1.2	
40	4062	8.0	4.746
41	4164	2.8	
42	4265	9.6	
43	4367	4.4	
44	4468	11.2	
45	4570	6.0	
46	4672	0.8	
47	4773	7.6	
48	4875	2.4	
49	4976	9.2	
50	5078	4.0	7.409
51	5179	10.8	
52	5281	5.6	
53	5383	0.4	
54	5484	7.2	
55	5586	2.0	
56	5687	8.8	
57	5789	3.6	
58	5890	10.4	
59	5992	5.2	
60	6094	0.0	10.680

Minutes.	Feet.	Feet.	Inch.
1	6094	0	10.680
2	12188	3	6.580
3	18282	7	11.853
4	24376	14	1.812
5	30470	22	1.932
6	36564	31	11.412
7	42658	42	5.436
8	48752	56	9.384
9	54846	71	9.876
10	60940	88	7.728
11	67034	107	2.940
12	73128	127	7.512
13	79222	149	9.444
14	85316	173	8.736
15	91410	199	4.320
16	97504	226	9.264
17	103598	255	11.568
18	109692	286	11.232
19	115786	319	7.188
20	121880	354	0.504
21	127974	390	4.248
22	134068	428	5.352
23	140162	468	10.224
24	146256	510	6.084
25	152350	553	11.232
26	158444	599	1.776
27	164538	646	1.680
28	170632	694	10.944
29	176726	745	5.568
30	182820	797	8.484
31	188914	851	9.828
32	195008	907	8.532
33	201102	965	3.528
34	207196	1024	7.884
35	213290	1085	9.600
36	219384	1148	8.676
37	225478	1213	5.112
38	231572	1277	10.908
39	237666	1348	2.064
40	243760	1417	1.764
41	249854	1496	11.388
42	255948	1569	10.452
43	262042	1638	9.084
44	268136	1716	0.108
45	274230	1794	11.424
46	280324	1875	7.032
47	286418	1958	0.000
48	292512	2042	2.328
49	298606	2128	2.016
50	304700	2215	6.792
51	310794	2305	5.472
52	316888	2396	9.240
53	322982	2489	10.368
54	329076	2584	8.856
55	335170	2681	4.704
56	341264	2779	9.912
57	347358	2880	0.480
58	353452	2982	0.408
59	359546	3085	8.628
60	365640	3191	2.208

from that height in miles. Example. Let the height of the eye be 49 feet. Multiply the square root of 49 or 7, by 1.2247, and we have 8.5729 or about $8\frac{1}{2}$ miles for the distance to which the eye can see at the height of 49 feet.

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The above table will answer several useful purposes. In the first place, the height of the apparent level above the true may be found by it at any distance, from one second to one degree, or $69\frac{2}{10}$ miles. Thus, at the distance of 30′=about 35 miles, we have 182820 feet for the length of the arch of a great circle on the earth, and corresponding to this we have 797 feet 8 inches 484 parts for the excess of the apparent level above the true. 2. The extent of the visible horizon corresponding to any height of the eye, may be found from the table by observation. The semidiameter of the horizon does not sensibly differ from an arc of a great circle on the earth, containing as many minutes and seconds as are equal to the angle of depression observed, and the number of feet contained in such an arc may be found in the table. Thus, if the depression, as observed by observation, be 40″, its semidiameter is also about 40″, and the length of the arc corresponding to it is 243,760 feet.

The following table, also taken from Cassini, shews the different depressions of the horizon of the sea at different heights of the eye, both by observation and calculation; with the difference betwixt the two occasioned by refraction.

The height of the eye above the surface of the sea.		*The depression of the horizon of the sea.*		
Feet.	Inches.	′	″	
1157	6,9	32	30	by observation
		36	18	by calculation
Difference by refraction		3	48	
775	2,3	27	0	by observation
		29	36	by calculation
Difference by refraction		2	36	
571	11,0	24	0	by observation
		25	25	by calculation
Difference by refraction		1	25	
387	3,4	19	45	by observation
		20	54	by calculation
Difference by refraction		1	9	
288	4,3	15	0	by observation
		17	1	by calculation
Difference by refraction		2	1	

The height of the eye above the surface of the sea.		*The depression of the horizon of the sea.*		
Feet.	Inches.	′	″	
187	0,9	13	0	by observation
		14	41	by calculation
Difference by refraction		1	41	
9	7,3	3	20	by observation
		3	18	by calculation
Difference by refraction		0	2	

In the above table, the depression, as estimated by calculation, is greater than that by observation in every case except the last, in which the latter is greater by two seconds than the former; but this difference was too small to be discovered by the instrument that Cassini employed.

Refraction lessens the angle of depression, by raising the objects observed; but as this refraction is itself variable, the depression and extent of the horizon also vary. We are informed by Cassini, that even in the finest weather he observed the refraction to differ at the same hour of different days, and at different hours of the same day. The truth of this observation may be easily ascertained by looking through a telescope furnished with cross hairs, and fixed in such a position that some highly elevated object, as the weathercock of a steeple, may be seen through it; for, on observing the weathercock at different times of the day, it will be seen sometimes on the centre of the object-glass; sometimes above, and sometimes below it. A similar experiment may also be made with plane sights fixed on a cross-staff. It has long been observed, that the top of a distant hill may sometimes, when the refraction is very great, be distinctly seen from a situation from which, at other times, when the refraction is much less, it is not discernible, even though the sky be very clear.

Many of the following problems may seem to belong to the celestial rather than the terrestrial globe; but as they may be solved equally well by means of both, and as persons not uncommonly possess a terrestrial globe without its usual companion, we shall throw as many problems as possible under this head.

PROBLEM IX. *To find the sun's place in the ecliptic for any given time.* 95 Problems respecting the sun.

Find the day of the month in the calendar on the wooden horizon; and opposite to it, in the adjoining circle, will be found the sign and degree in which the sun

From the above, it is easy to deduce the method of computing the distance of any object seen in the horizon from a certain height. Thus, suppose a man at the mast-head, 130 feet above the water, sees land or a ship just coming in sight. We know, that, at this height, an eye can see 14 miles, consequently the object seen will be about 14 miles or about five leagues distant. If the object is within the horizon, or nearer the place of observation, its distance may be calculated pretty exactly, by descending from the mast-head till the object just comes to the horizon; measuring the height at which this takes place, and thence computing the distance.

sun is on the given day. Then look for the same sign and degree in the circle of the ecliptic drawn on the globe, and that is the sun's place at noon for the given time.

Ex. 1. What is the sun's place on the 4th of June? *Ans.* In 13° 57′ of the sign Gemini.

Ex. 2. Required the sun's place for the first day of every calendar month?

For January	♑	11°	23′	July	♋	9°	42′
February	♒	12	35	August	♌	9	18
March	♓	11	9	September	♍	9	9
April	♈	11	56	October	♎	8	27
May	♉	11	14	November	♏	9	16
June	♊	11	3	December	♐	9	33

PROBLEM X. *To find the sun's declination for any given time.*

Find the sun's place for the given day by Prob. X. and bring it to the brazen meridian. The degree marked on the meridian immediately over the place is the declination required.

Ex. Required the sun's declination for 18th March? The sun's place for the given day is 20° 7′ of ♓, and this being brought to the meridian, will be immediately below 3° 54′ S. which is therefore the declination required.

From the above example, it is evident that the method of finding the declination of the sun corresponds to that of finding the latitude of a place on the globe, given in Problem I. the sun's declination being measured in the same way by an arc of the meridian interposed between the equator and the sun's place in the ecliptic (F).

PROBLEM XI. *To rectify the globe for the sun's place and the day of the month.*

Find the sun's declination for the given day, by Problem XI.; then elevate the pole that is in the same hemisphere with the degree of declination, as many degrees as are equal to the declination.

Ex. Rectify the globe for the sun's place on the 6th October? *Ans.* The sun's declination on that day is 5° S. therefore the south pole must be elevated 5° above the horizon.

Rectifying the globe for the sun's declination corresponds to the rectifying of it for the latitude of a given place. See N° 88.

PROBLEM XII. *To find the time of the sun's rising and setting at a given place, for any given day.*

Rectify the globe for the declination on the given day, and bring the given place to the meridian, and set the index of the hour circle at XII. Turn the globe, till the given place come to the eastern edge of the horizon, and the time of sunrise will be shewn by the position of the index. Then turn the globe till the given place come to the western part of the horizon, and the position of the index will point out the time of sunset.

To perform the same problem by Adams's globes. Rectify the globe for the declination, bring the given place to the meridian, and set the horary index at 12 as before; then turn the globe towards the west, till the given place reach the western edge of the horizon, and the index will point to the time of sunrise. The time of sunset will be known, in like manner, by bringing the place to the eastern side of the horizon.

If the hour circle in the ordinary globes has a double row of figures, the sun's rising and setting may be found at the same time; for if the place be brought to the eastern part of the horizon, the time of sunrise will be shewn by the index, in that circle where the hours increase towards the east; and the time cut by the index in the circle where the hours increase towards the west, will shew the time of sunset.

Ex. 1. Required the time of the sun's rising and setting at London, on the 29th August? *Ans.* The sun rises at nine minutes after five, and sets nine minutes before seven.

Ex. 2. Required the time of sunrise and sunset at Edinburgh on the 1st of June? *Ans.* For sunrise, 27 minutes after three; for sunset, 33 minutes after eight.

COROLLARY. From this problem we may easily find the length of the day and night for any given time; for, having found by the globe the time of sunrise and sunset, the double of the latter is the length of the day, and the double of the former the length of the night.

PROBLEM XIII. *To find the sun's meridian altitude on any given day, at a given place.*

Rectify the globe for the latitude of the given place, by Problem VIII.; find the sun's place on the given day by Problem IX. and bring it to the brazen meridian. Then fix the quadrant of altitude in the zenith, or over the given place, and bring it over the sun's place; and the degree of the quadrant lying over the sun's place will shew the meridian altitude.

If the globe has no quadrant of altitude, the sun's meridian altitude may be found by counting the number of degrees on the meridian, between the horizon and the sun's place.

Ex. Required the sun's meridian altitude at Edinburgh on the 21st of June? *Ans.* 57° 30′, or the greatest possible, this being the summer solstice.

COROLLARY. It may be known whether the sun's meridian altitude be north or south, by the following observations. When the sun's declination and the latitude of the place are of different names, i. e. the one north and the other south, the meridian altitude is of the same name with the declination. If the declination and latitude be both north or both south, the altitude is of the same name with the declination, if the latter be the greater; but, otherwise, the altitude is of an opposite name.

PROBLEM XIV. *Having the latitude of the place and the day of the month given, to find the sun's altitude for any given hour.*

Rectify the globe for the latitude; find the sun's place, and bring it to the meridian, and set the horary index

(F) For a table of the sun's declination corresponding to his true place, see Vol. III. p. 170.

index to noon; turn the globe till the index point to the given hour, then fix the quadrant of altitude in the zenith, and bring its graduated edge over the sun's place, and the degree cut by the sun's place will be the altitude required.

Ex. What will be the sun's altitude at 10 o'clock A. M. on the 30th of November at Edinburgh? *Ans.* 8° 50′.

PROBLEM XV. *Having the sun's meridian altitude given at any place, to find the latitude of the place.*

Bring the sun's place for the given day to the meridian, and move the globe in the horizon till the distance between the sun's place and the northern or southern edge of the horizon, (according as the case may require), be equal to the given altitude. The degree of elevation of the pole will shew the latitude required.

Ex. The sun's meridian altitude observed at a certain place on 5th August is 74° 24′ N. What is the latitude of the place? *Ans.* 1° 36′ N.

PROBLEM XVI. *The latitude of the place and the day of the month being given, to find when the sun is due east or due west.*

Rectify the globe for the latitude of the place, bring the sun's place to the meridian, and set the index to XII. Fix the quadrant of altitude in the zenith, and if the sun's declination be of the same name with the latitude, bring the graduated edge of the quadrant to the eastern side of the horizon; but if the declination is of a different name from the latitude, bring the quadrant to the western part of the horizon. Turn the globe till the sun's place in the ecliptic come below the edge of the quadrant, and the index will point to the hour when the sun is due east. Subtract this from XII. and the remainder shews the time when the sun is due west.

Ex. At what hours is the sun due east and west at the summer and winter solstice at Greenwich? *Ans.* At the summer solstice he is due east at 20 minutes past seven, and due west at 20 minutes before five. At the winter solstice he is due east at 20 minutes before five, and due west at 20 minutes past seven.

COROLLARY. When the declination and latitude are of the same name, the sun is due east after rising; but when the declination and latitude are of different names, he is due east before rising. As it is not convenient to observe on the globe when the sun is due east before rising, or while he is under the horizon, it is better to bring the opposite point of the ecliptic due west, and then the index shews the time when he is due east.

PROBLEM XVII. *Having a place in the torrid zone given, to find on what two days of the year the sun is vertical at that place.*

Find the latitude of the given place, and keeping that in view, turn the globe round, noting the two points at the ecliptic that pass below the degree of latitude. Find in the calendar circle of the horizon the days corresponding to those points of the ecliptic; and these are the days on which the sun is vertical at the given place.

Ex. 1. On what days is the sun vertical at St Helena, in latitude 15° 55′ S.? *Ans.* On the 6th February and 6th November.

Ex. 2. Required the days on which the sun is vertical at Tobago, in latitude 11° 29′ N.? *Ans.* On April 19. and August 23.

PROBLEM XVIII. *To find those places in the torrid zone where the sun is vertical on a given day.*

Find the sun's place for the given day, and bring it to the brazen meridian; then turn the globe, and note all the places which pass under that point of the meridian: these will be the places to which the sun is vertical on the given day.

Ex. 1. In what places is the sun vertical at the summer solstice? *Ans.* At Canton in China, at Calcutta in Bengal, at Mecca in Arabia, and at the Havannah.

Ex. 2. To what places is the sun vertical on the 16th of May and 29th of July? *Ans.* At Bombay, Pegu, in the northern part of Manilla, in the middle of the Ladrone islands, at Owhyhee, Mexico, in Hispaniola, and at Tombuctoo in the central parts of Africa.

PROBLEM XIX. *Having the day and hour at any given place, to find where the sun is then vertical.*

Find the sun's declination by Problem XI. and the places where it is noon at the given time, by Problem III.; then any of those places where it is noon, whose latitude is the same as the sun's declination, will have the sun vertical at the given time.

Ex. On the 1st of August at Edinburgh, it being 35 minutes past four, P. M. it is required to find where the sun is vertical? *Ans.* The sun's declination on that day is 18° 14′ N. and the place where it is noon at the given time, that lies nearest in latitude to the declination, is Kingston in Jamaica: this, therefore, is the place required.

PROBLEM XX. *A place in the northern frigid zone being given, to find when the sun begins to appear above the horizon, and when to disappear; as also the length of the longest day and night.*

Rectify the globe for the latitude, and bring the *ascending* signs of the zodiac (see ASTRONOMY, N° 52.) to the southern part of the horizon; observe what degree of the ecliptic is intersected by that point of the horizon, and in the calendar circle find the day of the month answering to that degree. That will shew the time of the sun's first appearance above the horizon at the given place, and this is the end of the longest night in that latitude. Then bring the *descending* signs to the same part of the horizon, and observe the day which answers to the degree of the ecliptic intersected; this will shew the time of the sun's disappearance, or the beginning of the longest night. Now bring the ascending signs to the northern part of the horizon, and observe the degree of the ecliptic, and the corresponding day as before, which will give the time when the sun begins to shine continually, or the beginning of the longest day. Again, bring the descending signs to the same point, and thus will be given the time when the sun ceases to shine continually, or the end of the longest day.

Ex. At what time does the sun begin to appear above

above the horizon at North Cape in Lapland, the latitude of which is 72° N.? When does he disappear, and how long is he entirely absent during the longest night? *Ans.* He begins to appear on the 26th of January, and entirely disappears on the 16th of November; he is therefore absent for 71 days.

Cor. From the sun's first appearance at the end of the longest night to the beginning of the longest day, and from the end of the longest day to the sun's total disappearance at the beginning of the longest night, he rises and sets every day.

Problem XXI. *To find in what part of the northern frigid zone the sun begins to shine continually on a given day.*

Find the sun's declination for the given day, and subtract this from 90°, the remainder will shew the latitude required.

Note.—The given day must be between the 21st of March and the 21st of June, as at no other time does the sun begin to shine continually in the northern frigid zone.

Ex. Required the latitude in which the sun begins to shine without setting on the 1st of June? *Ans.* The sun's declination for that day is 22° N. and this subtracted from 90° leaves 68° N. the latitude required.

96 Problems respecting the climates.

Problem XXII. *The length of the longest day in any place being given, to find the latitude of that place.*

Bring the 1st degree of Cancer to the meridian, and set the horary index at noon. Then turn the globe towards the west, till the index point to the hour of sunset, or half of the length of the given day; raise or depress the pole, till the sun's place in the ecliptic is exactly in the western edge of the horizon. The elevation thus obtained will be equal to the required latitude.

In Adams's globes, after bringing the first degree of Cancer to the meridian, and setting the index to noon, the globe must be turned towards the west, till the index shew the time of sunset, and the sun's place must be brought to the eastern side of the horizon.

Ex. In what latitude is the longest day 18 hours long? *Ans.* In latitude 58° 30′ N.

By this problem the limits of the hour climates may be pretty nearly ascertained.

Problem XXIII. *To find the latitudes of those places in the frigid zone where the sun is continually above the horizon for a given number of days.*

Count from the first degree of Cancer towards the nearest equinoctial point, as many degrees as is equal to half the given number of days; bring the point thus obtained below the meridian, and note the degree of the meridian which it intersects. This subtracted from 90° will leave a remainder that is nearly equal to the latitude of the place.

Ex. In what latitude does the sun never set during 76 days? *Ans.* In latitude 71° 30′, or very near the southern part of Nova Zembla.

Note.—This problem cannot be performed accurately by the globe; for as the sun requires 365 days six hours to move through the whole 360° of the ecliptic, he does not advance quite a degree in 24 hours.

By this problem the limits of the month climates may be pretty nearly ascertained.

Problem XXIV. *The hour and day being given at any place, to find in what places the sun is rising, and in what he is setting; where it is noon, and where midnight.*

Find by Problem XIX. the place to which the sun is vertical at the given time; rectify the globe for the latitude of that place, and bring the place below the meridian. In this position of the globe all those places that lie within the western edge of the horizon will have the sun rising, and all those which are in the eastern edge of the horizon will have it setting. Again, to those places which lie under the upper semicircle of the brazen meridian, it will be noon; and to those which lie below the lower semicircle, it will be midnight.

Ex. Suppose it be four o'clock P. M. on the 4th of June at London; where is the sun at that time rising, and where is he setting; to what places is it noon, and to what midnight? *Ans.* The north-eastern part of Siberia, Kamtschatka, the most western of the Sandwich isles, and the most eastern of the Society isles, are within the western edge of the horizon, and consequently to these the sun is rising. At Tobolsk, in the Caspian sea, in the desert of Arabia, in the middle of the Red sea, in Abyssinia, in the central parts of Africa, and in the country of the Hottentots, the sun will be setting, as these places lie within the eastern edge of the horizon. New Britain, the islands of Martinique and Trinidad, and the middle part of South America, which lie below the upper semicircle of the meridian, have noon; and Chinese Tartary, the eastern part of China, the Philippine isles, and the western part of New Holland, which are situated below the under edge of the semicircle, have midnight.

As the remaining problems on the terrestrial globe chiefly respect the continuance of twilight, it is proper, before we proceed, to make a few remarks on this subject. For the explanation of the term, see Crepusculum and Twilight.

The *Crepusculum*, or *Twilight*, it is supposed, usually begins and ends when the sun is about 18° below the horizon; for then the stars of the 6th magnitude disappear in the morning, and appear in the evening. It is of longer duration in the solstices than in the equinoxes, and longer in an oblique sphere than in a right one; because in those cases the sun, by the obliquity of his path, is longer in ascending through 18° of latitude.

Twilight is occasioned by the sun's rays refracted in our atmosphere, and reflected from the particles of it to the eye. For let A (fig. 10.) be the place of an observer on the earth ADL, AB the sensible horizon, meeting in B the circle CBM bounding that part of the atmosphere which is capable of refracting and reflecting light to the eye. It is plain that when the sun is under the horizon, no direct rays can come to the eye at A: but the sun being in the refracted line CG, the particle C will be illuminated by the direct rays of the sun; and that particle may reflect those rays to A, where they enter the eye of the spectator. And thus the sun's light illuminating an innumerable multitude of particles, may be all reflected to the spectator at A.

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A. From B draw BD touching the circle ADL in D, and let the sun be at S in the line AD; then the ray SB will be reflected into the situation BA, and will enter the eye, because from a principle in optics the angle of incidence DRC is equal to the angle of reflection ABE. See OPTICS. This ray SB, or BA, will therefore be the first that reaches the eye at dawn in the morning, and the last that falls on the eye at night, when twilight ceases, because as the sun gets lower down, the particles of the air at B will no longer be illuminated.

The depth of the sun below the horizon at the beginning of the morning or end of the evening twilight, is determined by observing the moment when the air first begins to shine in the morning, or ceases to shine in the evening; then finding the sun's place for that time, and hence the time till his rising in the horizon, or after his disappearance below. This depth of the sun below the horizon has been variously stated by different astronomers, but it is now generally estimated at 18°. Accordingly in Mr Adams's globes there is a circular wire fixed 18° below the horizon, to represent the limits of the crepusculum (see PWY, fig. 5.).

As the cause of twilight is not constant, its limits must continually vary; for if the exhalations in the atmosphere be more copious or more extensive than usual, the morning twilight will begin sooner, and that of the evening last longer than ordinary; as the more copious the exhalations, the more rays will be reflected from them, and consequently the more they will shine, and again, the higher they are, the sooner they will be illuminated by the sun. From this circumstance the evening twilight is commonly longer than the morning, at the same time, and in the same place. The refraction is also greater according as the air is more dense, and not only is the brightness of the atmosphere variable, but the same takes place in its height above the earth; therefore, the twilight is longest in hot weather, and in hot countries, all other things being equal. The chief differences, however, arise from the different situations of places on the earth, or from the difference of the sun's place in the heavens. Thus, the twilight is longest when the earth is in the position of a parallel sphere, and shortest in that of a right sphere (see N° 90.): and in an oblique sphere, the twilight continues longer at any place, in proportion as that place is nearer to either of the poles; a circumstance which affords considerable relief to the inhabitants of the northern countries in their long winter nights. Twilight continues longest in all places of north latitude, when the sun is in the tropic of Cancer, and to those in south latitude when he is in the tropic of Capricorn. The time of the shortest twilight also varies in different latitudes; thus, in England, the shortest twilight is about the beginning of October and of March, when the sun is in ♎ and ♓; hence, when the difference between the sun's declination and the depth of the equator is less than 18°, so that the sun does not descend more than 18° below the horizon, the twilight will continue through the whole night, as happens in Britain from the 22d of May to the 22d of July.

In the latitude of 49° N. twilight continues for the whole night, only on the 21st of June, or the time of the summer solstice: but at all places further to the north it continues for a certain number of days before and after the summer solstice.

Near the north pole there is continual twilight from the 22d of September, the time of the sun's permanent absence, to the 12th of November. It then ceases till about the 30th of January, when it again appears, and continues till the 21st of March, the time of the sun's permanent appearance. Hence the inhabitants of those places nearest the pole, though they never see the sun for nearly six months, have, however, the benefit of twilight for above the half of that time, and are entirely excluded from the sun's light little more than 12 weeks, during six of which the moon is constantly above the horizon.

98 Uses of twilight.

Were it not for the gradual change from light to darkness, and *vice versa*, which is the consequence of twilight, much inconvenience would arise. A sudden change from the darkness of midnight to the full splendour of the sun, and the reverse, would injure the sight, and would, in many cases, be productive of much danger to travellers, who would be overtaken by utter darkness before they had time to prepare for its approach.

99 Problems respecting twilight.

PROBLEM XXV. *To find where it is twilight at any given time.*

Find where the sun is vertical at the given time, and rectify the globe for the latitude of that place. Observe what places are within the limits of twilight, or not quite 18° below the horizon. To those which are situated within the western zone, between the horizon and the parallel of 18°, it will be twilight in the morning; and those which are in the eastern zone will have it twilight in the evening.

This problem may be more conveniently performed by rectifying the globe for the antipodes of the place which has the sun then vertical, and observing what places are situated in the zone formed above the horizon, between it and a parallel circle of 18°.

Ex. It is required to find where it is twilight on the 4th of June, when it is three o'clock P.M. at London. *Ans.* Kamtschatka, the Sandwich isles, and the Marquesas, have twilight in the morning; and the inhabitants of Madagascar, of Tibet, and the eastern part of Persia, have twilight in the evening.

PROBLEM XXVI. *To find the duration of twilight at a given place on any given day.*

Rectify the globe for the latitude of the place; find the sun's place for the given day by Problem X. and bring it below the meridian, and set the horary index to XII. Turn the globe till the sun's place be just within the circle that marks the limits of twilight, and the index will shew the beginning of twilight. Subtract the time of the beginning of twilight from the time of sunrising at the given place (found by Problem XII.) and the remainder will shew the duration of twilight at the given place.

Note.—The above rule will answer both for the ordinary globes, and for those of Adams, except that in the latter the sun's place must be brought below the western part of the horizon. A more convenient way in both globes will be, to bring that point of the ecliptic which is opposite to the sun's place, 18° above the

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the western horizon, and the index will then shew the beginning of twilight.

Ex. How long will twilight continue at London on the following days: March 2d; September 25th; and December 26th? *Ans.* On the 2d of March it will continue one hour and fifty minutes; on the 25th of September two hours; and on the 26th of December, two hours ten minutes (G).

100 Cause of day and night.

PROBLEM XXVII. *To shew the cause of day and night by the globe.*

It will have appeared, from the consideration of the cause of day and night given under the article ASTRONOMY, that only that half of the earth which is opposite to the sun, is illuminated by his rays, while that which is turned from him is involved in darkness. As the earth revolves on its axis from west to east, in the space of 24 hours, every place on the earth in the course of that time alternately enjoys the light of the sun, and is deprived of it.

To illustrate this by the globe, rectify the globe for the sun's declination, so as to place the sun in the zenith, and the horizon will represent the boundary between light and darkness; that hemisphere which is above the horizon being illuminated by the sun's rays, and that which is below the horizon being deprived of light. If now a patch is put on the globe, so as to represent any place, and if the globe be made to revolve from west to east; when the place is brought to the western edge of the horizon, the sun will appear to the inhabitants of that place to be rising in the east, though, in fact, the appearance arises from the place itself coming beyond the limit of darkness. As the globe continues to turn, the place rises towards the meridian, and this produces the appearance as if the sun were advancing towards the meridian in a contrary direction. When the place comes below the meridian, it is noon to that place, and the sun appears to have attained its greatest height.

As the place proceeds towards the east, it gradually recedes from the meridian, and the sun appears descending in the west. When it reaches the eastern edge of the horizon, and is proceeding below the boundary of light aud darkness, the sun appears to be setting; and during the whole time that the place is moving below the horizon, the sun will not appear till the place once more rises in the west.

101 Problem on lunar eclipses.

PROBLEM XXVIII. *To find at what places an eclipse of the moon is visible at any given time.*

Find the place to which the sun is vertical at the given time, and rectify the globe for the latitude of that place. As the moon is opposite to the sun, which illuminates the superior hemisphere of the globe, the eclipse of the moon will be visible to all the places that lie below the horizon.

As the places below the horizon are not easily examined, this problem may be more conveniently performed by rectifying the globe for the antipodes of the place to which the sun is vertical at the given time, rather than for the place itself; as in this latter position of the globe the moon being in opposition to the sun, will be vertical to the place below the zenith, and its eclipse will be visible at all the places now above the horizon.

Ex. 1. On the 4th of January 1806, at 55 minutes past 11 P. M. reckoning the time at Greenwich, there was an eclipse of the moon. It is required to find those places to which the eclipse was visible? *Ans.* Through the greatest part of Africa, in some part of Europe, in Asiat South America, and a great part of North America.

Ex. 2. On the 10th of May 1808, when it is eight o'clock A. M. at Greenwich, the moon will be totally eclipsed. In what places will the eclipse be visible? *Ans.* In most parts of America; in the islands of the Pacific ocean, and on the eastern coast of New Holland.

SECT. II. *Of the Use of the Celestial Globe.*

1 Celestial globe.

The celestial globe, with respect to the circles that are described on it, and the apparatus with which it is furnished, scarcely differs from the terrestrial globe, which has been so fully described in the preceding section. The surface of the celestial globe is made to represent all the stars that are commonly visible to the naked eye, arranged under their constellations, and bounded by the figures which have been given to these constellations by the early astronomers. (See fig. 5.). In Adams's celestial globe the moveable semicircle (N° 91.) turning round the poles represents a circle of declination, and the small circle on it, an artificial sun or planet.

Both the globes are often furnished with a mariner's compass, which is usually placed in the lower part of the frame.

It must here be remarked, that the representation of the heavens on the celestial globe, though probably much more accurate than that of the earth on the terrestrial, is not so natural as the latter; for, in viewing the stars on the external surface of a globe, the spectator sees them in an opposite position to that in which he observes them in the heavens, so that to form a just conception of their exact situation, he must suppose his eye to be seated in the centre of the globe. Hence, if a large hollow hemisphere were made of glass, and if the stars in the corresponding hemisphere of the firmament were painted in transparent colours on its surface; an eye situated in the centre of such a hemisphere

(G) If we have the latitude of a place, and the sun's declination given, we may find the beginning of the morning and the end of the evening twilight by calculation. Thus, in the oblique-angled spherical triangle ZPN (fig. 11.) we have given ZP the co-latitude; PN the co-declination, and ZN$=108°$ being the sum of $90°$ the quadrant, and $18°$ the depression at the extremity of twilight. Then by spherical trigonometry we may calculate the triangle ZPN, the hour angle from noon, and this reduced to time, at the rate of $15°$ per hour, gives the time from noon to the beginning or end of twilight. For the mode of calculation, see SPHERICS.

sphere would see the stars exactly as they appear in the heavens.

The great use of the celestial globe is to perform a variety of problems with respect to the stars, and the motions of the heavenly bodies through the space which they occupy.

PROBLEM I. *To place the celestial globe in such a situation as that it shall exhibit an accurate representation of the face of the heavens at any given place, and at any given time.*

Rectify the globe for the latitude of the place, as in Problem VII. of the terrestrial globe, or by setting the pole of the celestial globe pointing to the pole of the earth, by means of the compass that is usually annexed to the globes; find the sun's place in the ecliptic; bring this to the meridian, and set the horary index at noon. Again, make the globe turn on its axis till the index point to the given time, and in this position the globe will exactly represent the face of the heavens, corresponding to the given time and place; every constellation and star in the heavens answering in position to those on the globe. Hence, by examining the globe, it will immediately be seen what stars are above or below the horizon, which are on the eastern and western parts of the heavens, which have just risen above the horizon, and which are about to sink below it.

As this problem will be found extremely useful to the student of astronomy, we shall here quote the example given in illustration of it by Messrs Bruce of Newcastle.

"Required the situation of the stars for the latitude of Newcastle, on October 6th, at eight o'clock in the evening?

"In our present survey of the heavens, we shall commence at the north point of the horizon, and proceed round eastward; noticing the different constellations, and the relative situation of the principal stars in these constellations.

"The first star which strikes the eye of the observer, in the north-east part of the heavens, is Capella, in the constellation Auriga, or the Waggoner: It is of the first magnitude, of the altitude of 23°, or nearly the fourth part of the distance from the horizon to the zenith. There are two stars of the second magnitude, which form with Capella a triangle:—The star which forms the short side of the triangle is in the right shoulder of Auriga, and is marked β; it lies at the distance of about 8° from Capella, further to the north; its altitude is 18°:—The star forming the longer side of the triangle is in the Bull's northern horn; its distance from Capella is more than 26°; its altitude not more than 5°, and azimuth N. E. There are three stars of the fourth magnitude, a little to the south of Capella, that bear the name of the *Kids*.

"If a line be drawn through the two stars that form the upper side of the triangle, and continued to the horizon, it will point out Castor, α, in Gemini just rising, azimuth E. N. E: it is between the first and second magnitude. The other stars in this constellation have not yet risen.

"A line drawn between Castor and Capella, and continued higher in the heavens, will point out Perseus, in which there are three stars, one of the second magnitude, α, named *Algenib*, and two of the third magnitude, one on each side of Algenib, at the distance of about 5°: they form a line a little curved on the side next Auriga. The altitude of Algenib is 37°; azimuth N. E. by E.

"A little to the south of Perseus is the Head of Medusa, which Persens is holding in his hand. Besides two or three small stars it contains one of the second, and one of the third magnitude. The name of the brightest is *Algol;* altitude 33°, azimuth E. N. E. Algol is only 10° distant from Algenib.

"Directly below the Head of Medusa, about 14° above the horizon, are the Pleiades or seven stars: They are seated in the shoulder of Taurus, and are so easily known, that no description is necessary. Aldebaran, a star of the first magnitude, which forms the eye of Taurus, is just rising; azimuth E. N. E. A vertical circle drawn through Algol will point to it. There are two stars of the third magnitude, and several smaller very near Aldebaran, which form with it a triangle. The whole cluster is called the *Hyades*.

"A line drawn from Aldebaran through Algol, and continued to the zenith, will direct to Cassiopeia. This contains five stars of the third magnitude, besides several of the fourth: it is in form something like the letter Y, or, as some think, an inverted chair. It is situated above Persens, within 30° of the zenith. The altitude of the brightest star, α, called *Schedar*, is 60°; azimuth, E. N. E,

"Below Cassiopeia and west of Perseus is Andromeda, which contains three stars of the second magnitude. A line from Algenib, parallel to the horizon towards the south, will pass very near these three stars; and, as they are all of the same magnitude, and placed nearly at the same distance of 15° from each other, they may easily be known. The name of the star nearest Perseus, and which is in the foot of Andromeda, marked γ, is Almaak: its altitude is 49°; azimuth E. N. E. The name of β, in the girdle, is Mirach: its altitude 44°; azimuth E. The altitude of α, in the head of Andromeda, is 46°; azimuth E. S. E.

"About 18° below Mirach are two stars in Aries, not more than 5° distant from each other, forming with Mirach an isosceles triangle: the most eastern star, α, is of the second magnitude; the other, β, of the third, attended by a smaller star, marked γ, of the fourth magnitude. A line drawn from Mirach, perpendicular to the horizon, will pass between the two, and besides, will point to a star of the second magnitude, directly E. not above 3° from the horizon.

"This star is the first of Cetus, maked α, and is of the second magnitude: it is named *Menkar*. A line drawn from Capella through the Pleiades will also point to it. Cetus is a large constellation, and contains eight stars of the third magnitude; they all lie to the west of Menkar; β, a star in the tail, is more than 40° distant from it. The azimuth of β is S. E. by E; altitude nearly the same as Menkar.

"The constellation Pisces is situated next to Aries; it contains one star of the third magnitude, marked α: its altitude is 10°, azimuth E. by S. It is distant from Menkar 15°. A line drawn from Almaak, through α in Aries, will point to it.

"If we return again to α in the head of Andromeda, we shall find three other stars nearer the meridian, which, with

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with it, form a square. These stars are in Pegasus, and are placed at the distance of 15° from each other; they are all of the second magnitude. The two stars forming the western side of the square are called—the upper one Scheat, which is marked β, and which is in the thigh of Pesagus; the under one Markab, which is marked α, and which is in the wing; the lowest star in the eastern side of the square is in the tip of the wing, and is marked γ. The altitude of Scheat is 55°; azimuth S. E. ½ E. Altitude of Markab, 43°; azimuth S. E. by S. ½ E.

"A line drawn through γ and β (the diagonal in the square of Pegasus) and continued to the meridian, will point out Cygnus, a remarkable constellation in the form of a large cross, in which there is a star of the second magnitude, named *Deneb* or *Arided;* it is marked α, and is almost directly upon the meridian at the altitude of 80°. Cygnus contains six stars of the third magnitude. The constellation Cepheus, which contains no remarkable stars, is situated between Cygnus and the north pole.

"Below Pegasus, and nearer the meridian, is Aquarius, containing four stars of the third magnitude. A line drawn from α in Andromeda, through Markab, will point to α in Aquarius. Its altitude is 32°; azimuth S. S. E.

"A bright star of the first magnitude named *Fomelhaut*, in Pisces Australis, is then upon the horizon; azimuth S. S. E.

"Delphinus is a small constellation, situated about 30° below Cygnus upon the meridian; it contains five stars of the third magnitude, four of them being placed close together, and forming the figure of a rhombus or lozenge. A line drawn through the two under stars of the square will point to it. Its altitude is about 50°.

"A little to the west of Delphinus, but not quite so high, is Aquila, containing one very bright star of the first magnitude, named *Atair:* It may very easily be known from having a star on each side of it of the third magnitude, forming a straight line. The length of the line is only about 5°; altitude of Atair 40°; azimuth S. S. W.

"Considerably above Atair, and a little to the W. of Cygnus, is Lyra, containing a star of the first magnitude, one of the most brilliant in the firmament. It is called Lyra or Vega, and is 35° to the N. W. of Atair; altitude 60°; azimuth W. S. W. Lyra, Atair, and Arided, form a large triangle.

"We come now to notice three constellations, which occupy a large space in the western side of the heavens: these are Hercules immediately below Lyra; Serpentarius between Hercules and the horizon, extending a little more towards the south; and Boötes, reaching from the horizon W. N. W. to the altitude of 45°.

"Hercules contains eight stars of the third magnitude; the star in the head, α, named Ras Algethi, is within 5° of α in the head of Serpentarius. This last is a star of the second magnitude, and is named Ras Alhague: its altitude is 30°; azimuth, S. W. by W. ½ W. A line drawn from Lyra, perpendicular to the horizon, will pass between these two stars. The other stars in Hercules extend towards the zenith, and those in Serpentarius towards the horizon.

"The constellation Boötes may easily be known from the brilliancy of Arcturus, a star of the first magnitude, and supposed to be the nearest to our system of any in the northern hemisphere: it is within 10° of the horizon; azimuth W. N. W. Boötes also contains seven stars of the third magnitude, mostly situated higher in the heavens than Arcturus. The star immediately above Arcturus is called Mezen Mirach, and is marked ε. The star in the left shoulder, δ, named Seginus, forms with Mirach and Arcturns a straight line.

"Between Serpentarius and Boötes is *Serpens*, containing one star of the second magnitude, and eight of the third: α in *Serpens* is nearly at the same distance from the horizon, as Arcturus; azimuth W.

"Above Serpens, and a little to the east of Boötes, is the Northern Crown, containing one star of the second magnitude, named Gemma, and several of the third, which have the appearance of a semicircle. A line drawn from Lyra to Arcturus will pass through this constellation.

"We come now to Ursa Major, a constellation containing one star of the first, three of the second, and seven of the third magnitude. It may easily be distinguished by those seven stars, which, from their resemblance to a waggon, are called Charles's Wain. The four stars in the form of a long square, are the four wheels of the waggon; the three stars in the tail of the Bear, are the three horses, which appear fixed to one of the wheels. The two hind wheels, α named Dubhe, and β, are called the pointers, from their always pointing nearly to the north pole. Hence the pole star may be known. The altitude of Dubhe is 30°; azimuth N. by W. ½ W. The distance between the two pointers is 5°; the distance between the pole star and Dubhe, the upper pointer, is 30°.

"Ursa Minor, besides the pole star of the second magnitude, situated in the tail, contains three of the third, and three of the fourth magnitude. These form some resemblance to the figure of Charles's Wain inverted, and may easily be traced.

"Draco, containing four stars of the second and seven of the third magnitude, spreads itself in the heavens near Ursa Minor: the four stars in the head are in the form of a rhombus or lozenge: the tail is between the pole star and Charles's Wain.

"Besides these constellations, there are a number of others, which, as they contain no remarkable stars, we have not described; an enumeration of these will suffice. The Lynx, between Ursa Major and Auriga; Camelopardalus, between Ursa Major and Cassiopeia; Musca, and the Greater and Less Triangles between Aries and Perseus, Aculeus, close to the head of Pegasus; Sagittarius setting in the south-west; Antinous and Sobieski's Shield below Aquila; the Fox and Goose between Aquila and Cygnus; the Greyhounds and Berenice's Hair between Boötes and Ursa Major, and Leo Minor below Ursa Major *."

The astronomical terms that we must here employ in describing the method of performing the problems on the celestial globe, will be found explained in the article ASTRONOMY, or under their proper heads in the general alphabet of this work. See ASCENSION, AZIMUTH, DECLINATION, &c.

* Bru[illegible] Introduction t[illegible] Geogr[illegible] and A[illegible]nomy, ed. p. [illegible]

PROBLEM

Problems respecting the stars.

PROBLEM II. *To find the right ascension and declination of any given star.*

Bring the given star below the brazen meridian, and mark the degree of the meridian under which it lies. That degree shews the declination of the star, and the degree of the equator cut by the meridian gives the star's right ascension.

The right ascension of a star may also be found by placing the globe in the position of a right sphere, and then bringing the star to the eastern part of the horizon; for that point of the equator which comes to the horizon at the same time with the star, marks its right ascension. See ASTRONOMY, N° 249, 250.

Ex. 1. What is the right ascension and declination of the star Sirius? *Ans.* Its right ascension is 99°, and its declination 16° 27′ S.

Ex. 2. Required the right ascension and declination of Aldebaran, or the star in the Bull's Eye marked α? *Ans.* Its right ascension is 66°, and its declination 16° 5′ N.

PROBLEM III. *Having the right ascension and declination of a star given, to find the star on the globe.*

Bring the degree of the equator which marks the right ascension below the brazen meridian, and counting along the meridian towards the north or south, as far as the degree of declination, the required star will be there found.

Ex. 1. The right ascension of a certain star is 162° 15′, and its declination is 57° 27′ N.; What is the name of the star? *Ans.* The lower pointer of Ursa Major, marked β.

Ex. 2. The right ascension of Arcturus is 211° 30′, and its declination is 20° 13′ N.: it is required to find it on the globe.

This problem is extremely useful in discovering the names and relative situations of the different stars.

PROBLEM IV. *To find the latitude and longitude of a given star.*

Bring the solstitial colure (see N° 75.) below the brazen meridian, and there fix the quadrant of altitude over the pole of the ecliptic which is in the same hemisphere with the given star. Then, keeping the globe steady, bring the graduated edge of the quadrant over the given star, and the degree of the quadrant cut by the star, counted from the ecliptic, marks its latitude, and the degree of the ecliptic that is cut by the quadrant is the longitude of the given star (H). See ASTRONOMY, N° 252, 253.

Ex. 1. What is the latitude and longitude of Arcturus? *Ans.* Lat. 31° N. Long. Libra 20°.

Ex. 2. What is the latitude and longitude of Capella? *Ans.* Lat. 23° N. Long. Gemini 18° 30′.

PROBLEM V. *Having the day of the month given, to find at what hour any star comes below the meridian.*

Find the sun's place, and bring it to the meridian, and set the horary index to XII.; turn the globe till the given star come below the meridian, and the index will point out the hour.

To know whether the hour is in the forenoon or afternoon, it is necessary to observe, that if the star be to the east of the sun, it will reach the meridian later than the sun, but if it be to the west of that luminary, it will come to the meridian sooner: hence, in the former case, the hour will be P. M. and in the latter A. M.

Ex. 1. At what hour does Sirius come to the meridian on the 9th of February? *Ans.* At 7 minutes past 9 P. M.

Ex. 2. Required the hour when Castor passes the meridian on the same day. *Ans.* At 52 minutes past 9 P. M.

PROBLEM VI. *Having any star given, and a given hour, to find on what day the star will come to the meridian at a given hour.*

Bring the given star below the meridian, and set the horary index to the given hour. Make the globe revolve till the index come to twelve at noon; and the day of the month which corresponds to the degree of the ecliptic then below the meridian, found in the calendar circle of the wooden horizon, will be the day required.

Ex. 1. On what day does Algenib, the first star of Perseus, come to the meridian at midnight? *Ans.* On the 13th of November.

Ex. 2. On what day does Arcturus come to the meridian at 9 o'clock P. M. *Ans.* On the 10th of June.

PROBLEM VII. *Having the latitude, the day of the month, and the hour of the night given, to find the altitude and azimuth of any given star.*

Rectify the globe for the given latitude; bring the sun's place below the meridian, and set the horary index at XII. then turn the globe till the index point at the given hour. Fix the quadrant of altitude at 90° from the horizon, that is, in the zenith, and bring its graduated edge over the place of the star: the degree of the quadrant intercepted between the horizon and the star is the altitude required; and the distance between the foot of the quadrant and the nearest part of the horizon, will be the azimuth.

It is evident that this problem on the celestial globe is exactly similar to Problem XIII. on the terrestrial globe, for finding the altitude of the sun.

Ex. 1. What will be the altitude and azimuth of Cor Hydræ on the 21st of December at London, at 4 o'clock A. M.? *Ans.* The altitude 30°, the azimuth S. 14° W.

Ex. 2. Suppose an observer at the Cape of Good Hope, on the 21st of June at midnight; required the altitude and azimuth of Arcturus to him? *Ans.* Altitude 12°, azimuth N. 55° W.

PROBLEM VIII. *Having given the azimuth of any given star, and the day of the month in a given latitude; to find the hour of the night, and altitude of the star.*

Rectify the globe as in the last problem; fix the quadrant of altitude in the zenith, and bring it to the given azimuth. Turn the globe till the star comes below

(H) It must be remembered that the longitude of the heavenly bodies is not estimated in degrees and minutes like their right ascension, but in signs, degrees, and minutes, as the sun's place is reckoned.

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low the graduated edge of the quadrant, when the horary index will point out the hour, and the altitude of the star will be seen by the quadrant.

Ex. Suppose the azimuth of Dubhe to be N. 23° W. at London on the first of September; it is required to find the altitude of the star, and the hour of the night? *Ans.* The altitude of Dubhe at that time is 31°, and the hour is 9 o'clock P. M.

PROBLEM IX. *The latitude of the place, the altitude of a star, and the day of the month, being given; to find the azimuth and the hour of the night.*

Rectify the globe as before, and having fixed the quadrant of altitude in the zenith, turn the globe and quadrant of altitude till the latter comes over the star at the given degree of altitude. In this position the index will shew the time of night, and the position of the quadrant at the horizon will shew the azimuth of the star.

In the same way the hour of the night and the azimuth of the sun may be found, by fixing a patch on the globe in the sun's place, and bringing it to the quadrant as directed for the star.

As the sun and stars have the same altitude twice in the day, it is proper to know whether they are to be east or west of the meridian; or whether the hour required be in the evening or the morning.

Ex. At Edinburgh, on the 25th of December, in the forenoon, when the sun's altitude is 7° 20′, required the hour and the sun's azimuth? *Ans.* It is 10 o'clock A. M. and the sun's azimuth is S. 27° 30′ E.

PROBLEM X. *Having the azimuth of the sun or a star, the latitude of the place, and the hour of the day given; to find the altitude and day of the month.*

Rectify the globe for the latitude of the place, fix the quadrant in the zenith, and bring its edge under the given azimuth. Bring the sun's place or the star to the edge of the quadrant, and set the index at the given hour. The degree marked in the quadrant will shew the altitude; and if the globe be turned till the index points to twelve at noon, the day of the month, answering to that degree of the ecliptic which is intersected by the brazen meridian, is the day required.

Ex. The azimuth of the star α in the Northern Crown was observed at London at 9 o'clock P. M. to be S. 89° W.; required the altitude and day of the month? *Ans.* Altitude 30°; day of the month 1st of September.

PROBLEM XI. *Having observed two stars to have the same azimuth; to find the hour of the night.*

Rectify the globe as before; turn the globe and move the quadrant till the edge of the latter comes over both stars, and the horary index in this position of the globe will give the hour required.

The following is a simple and easy method of finding when two stars have the same azimuth. Hold a small line with a plummet at its lower extremity between the eye and the two stars, and if both stars fall within the line, they have the same azimuth. The same may be done by observing when any two stars pass behind the perpendicular edge of a wall at the same time.

Ex. Vega and Atair were observed to have the same azimuth at London on the 11th of May; required the hour of the night? *Ans.* 15 minutes past 2 A. M.

This problem may be applied to the regulating of clocks and watches, by reducing apparent to real time, as explained under ASTRONOMY.

PROBLEM XII. *To find the rising, setting, and culminating of any star or planet, its continuance above the horizon, its oblique ascension and descension, and its eastern and western amplitude; the place and day being given.*

Rectify the globe as in the foregoing problems; bring the given star or the given planet (finding its place in an ephemeris for the given day, and marking it by a patch on the globe) to the eastern part of the horizon, and the index of the hour circle will point out the time of rising: the degree of the equator that comes to the horizon with the given star or planet, marks its oblique ascension, and the eastern amplitude is shewn by the distance of the star or planet from the eastern part of the horizon.

Bring the star or planet to the meridian, and the index will point to the time of its culminating.

Move the globe till the star or planet come to the western part of the horizon, and the time of its setting, its oblique descension, and its western amplitude, may be found in the same manner as directed above; for its rising, oblique ascension, and eastern amplitude, the number of hours passed over by the index, while the star or planet is moving from east to west, will shew the time of its continuance above the horizon.

Ex. 1. Required the above circumstances with respect to Sirius on the 14th of March at London. *Ans.* It rises at 24 minutes past two P. M.; comes to the meridian, or culminates, at 57 minutes past six P. M.; and sets at half-past eleven P. M. Hence it remains above the horizon nine hours and six minutes. Its oblique ascension is 120° 47′, its oblique descension 77° 17′, and its amplitude 27° S.

Ex. 2. It is required to find the situation of the several planets on the 19th of January 1806. *Ans.* Mercury is about 22° to the west of the sun, and rises south-east by east, at 20 minutes before seven A. M. Venus is an evening star, and sets about half past eight. Mars is a very little to the east of the sun, and rises and sets so near the same time with the sun, that he cannot be seen. Jupiter is a morning star, and rises about six o'clock. Saturn is a little to the east of the star Spica Virginis, and rises about half an hour after midnight. Herschel is very near Saturn, and rises about the same time.

PROBLEM XIII. *To find those stars which never rise, and those which never set, in a given latitude.*

Rectify the globe for the latitude of the place; then, holding a black lead pencil so as to touch the surface of the globe at the northern point of the horizon, turn the globe, so that the pencil may describe a circle: all the stars which are between this circle and the elevated pole, never set. Again, holding the pencil at the southern point of the horizon, turn the globe so as to describe another circle there, and all the stars that are between that circle and the pole, below the horizon, never rise.

If the place is in southern latitude, the stars that never set are found by describing a circle at the southern point

point of the horizon, and those that never rise by a similar circle at the northern point (1).

Throughout almost the whole year, the moon rises later every successive day, by above three quarters of an hour; but at a considerable distance from the equator, as in the latitude of Britain, France, and some other countries, a remarkable anomaly takes place in the moon's motion about the time of harvest. At this season, when the moon is about full, she rises for several nights successively at about 17 minutes later only than on the preceding day. This is attended with considerable advantage, for as the moon rises before twilight is well ended, the light is as it were prolonged, and thus an opportunity given to the industrious farmer to continue longer in the field, for the purpose of gathering in the fruits of the earth. From the advantage derived from the full moon at the season of harvest, it has been called the *harvest moon*. The following problem has been contrived for the purpose of illustrating the phenomenon by means of the globe.

Problem XIV.

Rectify the globe for any considerable northern latitude, suppose that of London. As the angle which the moon's orbit makes with the ecliptic is but small, we may suppose, without any considerable error, her orbit to be represented by the ecliptic. In September the sun is in the beginning of ♎, so that the moon, when full, being in opposition to the sun, must be in or near the beginning of ♈. Put a patch, therefore, in the globe at the first point of ♈ in the ecliptic; and as the moon's mean motion is about 13° in a day, put another patch on the ecliptic 13° beyond the former, and it will point out the moon's place the night after it is full. A third and fourth patch, put at the distance of 13° further on, will shew the moon's place on the second and third nights after full, &c. Now, bring the first patch to the horizon, and observe the hour pointed out by the index; turn the globe till the second patch comes to the horizon, and it will appear by the index that there are only 17 minutes between the time of the first patch rising, and that of the second. This small difference in the motion of the moon evidently arises from the small angle which her orbit makes with the horizon. The remaining patches will come to the horizon with a little greater difference of time, and this difference will gradually increase as the moon advances in the ecliptic; but for the first week after the full moon at harvest the difference will not be more than two hours. If patches be continued on to the first point in ♎, it will be found that the time of their 'rising,' or coming to the horizon, will increase considerably till the last will be above 1¼ hour later in coming to the horizon, because that point of the ecliptic makes the greatest angle with the horizon.

The point of the eliptic, which makes the least angle with the horizon at rising, makes the greatest angle at setting; and, consequently, when the difference is least at the time of rising, it is greatest at the time of setting.

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104 Equation of time illustrated.

Problem XV. *To explain the equation of time by the globe.*

The difference between apparent time and mean or equal time, has been explained in Astronomy, from N° 50 to 60; and the method of computing the equation of time is also there described.

To explain the equation of time on the globe, make, with a black lead pencil, marks all round the equator and ecliptic, beginning with ♈, at equal distances from each other, suppose about 15°. Then, on turning the globe, it will be seen that all the marks on the first quadrant of the ecliptic, reckoning from ♈ to ♋, come to the brazen meridian sooner than the corresponding marks on the first quadrant of the equator. Now, as the former marks represent time as measured by the sun, or a dial, and the latter represent it as measured by an accurate clock, it will be evident, that through the first quarter the dial is faster than the clock.

Still turning the globe, it will be seen that the marks on the second quarter of the ecliptic, reckoning from ♋ to ♎, come to the meridian later than the corresponding marks of the equator; consequently in this quarter the sun or the dial is slower than the clock. By moving the globe round, and marking the approach of the dots in the third quadrant, it will be seen that, as in the first, the dial now precedes the clock, and in the fourth quadrant, that it is behind it, according to the explanation given in Astronomy.

Sect. III. *Of the Constructiou of Globes.*

105 General construction of globes.

The construction of globes is of considerable importance; as, in performing the problems in which they are employed, very much depends on the accuracy with which they have been constructed. We shall here, therefore, describe pretty minutely the methods in which the artists of Britain and France make their globes.

There are certain general circumstances which are attended to in the construction of every globe.

There is first provided a wooden axis, somewhat less than the intended diameter of the globe, and to the extremities of this axis, which is the basis of the whole succeeding structure, there are fixed two metallic wires, to serve as poles. Now, two hemispherical caps formed on a wooden mould or clock, are applied in the axis. These caps are composed of pasteboard, or folds of paper laid one over another on the mould, till they are of the thickness of a crown piece; and after the whole has stood to dry, and has become a solid body, an incision is made with a sharp knife along the middle, and the two caps are thus slipped off the mould. These caps are now to be applied on the poles of the axis, as they were before on those of the mould; and to fix them

(1) This problem may be performed without the globe, by the following method. Find the latitude of the place in a table, and subtract it from 90°; the remainder will be the complement of the latitude. Then, if the declination of the given star be of the same name with the co-latitude, and exceed it in quantity, it will never set. If it be of a contrary name, and exceed it, it will never rise.

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them firmly on the axis, the two edges are sewed together with packthread.

When the rudiments of the globe are thus laid, the artist proceeds to strengthen the work, and make the surface smooth and equal. For this purpose, the two poles are fixed in a metallic semicircle, of the proposed size; and a composition made of whitening, mixed with water and glue, heated, melted, and incorporated together, is daubed all over the paper surface. While the plaster is applied, the globe is turned round in the semicircle, the edge of which pares away all the matter that is superfluous and exceeds the proper dimensions, and spreads the rest over those parts that require it. After this operation the ball stands to dry, and when it is thoroughly dried, it is again put in the semicircle, and fresh plaster applied to it; and thus they continue to apply composition and dry the ball alternately, till the surface accurately touches the semicircle in every point, when it becomes perfectly firm, smooth, and equal.

When the ball of the globe is thus finished, the map, containing a delineation of the surface of the earth, is to be pasted on the globe. For this purpose, the map is engraved in several gores or gussets, so that when these are accurately joined together on the spherical surface, they may cover every part of the ball, without overlapping each other. The greatest nicety is required in forming these engraved gussets, as well in the accuracy of the engraving, as in the choice and shape of the paper employed. The method of describing the gores or gussets, usually employed by the British artists, is as follows.

1. From the given diameter of the globe there is found a right line AB (fig. 12.), equal to the circumference of a great circle corresponding to that diameter; and this line is divided into 12 equal parts.

2. Through the several points of division, 1, 2, 3, 4, &c. with a distance equal to ten of the divisions, arches are described crossing each other as in D and E; and these figures are pasted on the globe, so as when joined together to cover its whole surface.

3. Each part of the line AB is divided into 30 equal parts, so that the whole line, which may represent the equator, is divided into 360°.

4. From the points D and E, which represent the poles, with a distance $=23\frac{1}{2}°$, there are described arches *a b*, *a b*, (fig. 13.) which form twelfth parts of the polar circles.

5. In a similar manner about the same poles D and E, with a distance $=66\frac{1}{2}°$, reckoned from the equator, there are described other arches, *c d*, *c d*, which are the twelfth parts of the tropics.

6. In forming the celestial globe, through the point of the equator marked *e* (fig. 13.) representing the right ascension of a given star, and through the two poles D and E, there is drawn an arch of a circle; and if the complement of the declination from the pole D be taken in the compasses, and an arch be described, intersecting the former in the point *i*, this point *i* will be the place of the given star.

7. In this way all the stars of each constellation are laid down, and the circumscribing outline of the constellation is drawn as figured in the tables of Bayer, Flamstead, &c.

8. In the same manner are determined the declinations and right ascensions of every degree of the ecliptic, *d g*.

The above is the method described by Mr Chambers, of laying down or delineating the gores of a celestial globe. Those of the terrestrial globe are delineated in much the same manner, only that every place is laid down on the gores, according to its longitude and latitude, determined by the intersection of circles; and then the outline of the coasts, boundaries of countries, &c. are added, like the figures of the constellations above mentioned.

9. When the surface of the globe has been thus projected on a plane, the gussets are to be engraved on copper, to save the trouble of making a new projection for every globe.

10. In the mean time, a ball of paper, plaster, or the like, of the intended diameter of the globe, is prepared in the manner above described, and by means of a semicircle and style, great circles are drawn on its surface, so as to divide it into a number of equal parts, corresponding to the number of gussets; and subdividing each of these according to the other lines and divisions of the globe. When the ball is thus prepared, the gussets are to be accurately cut from the printed engraving, and pasted on the ball.

When the papers have been thus pasted on, and suffered to dry, nothing remains but to colour and illuminate the globe, and to cover it with a thin layer of the finest varnish, that it may the better resist dust and moisture. The ball of the globe is now finished, and is to be hung in a strong brazen meridian furnished with hour circles and a quadrant of altitude, and fitted into a strong wooden horizon.

The method employed by the French artists in projecting the gussets of globes, is thus described by M. La Lande.

"To form celestial and terrestrial globes, it is necessary to engrave gores, which are a sort of projection or developement of the globe. The length PC (fig. 14.) of the axis of the curve, is equal to a fourth part of the circumference of the intended globe; the intervals of the parallels on the axis PC are all equal; the radii of the circles K D I, which represent the parallels, are equal to the co-tangents of the latitude, and the arches of each, such as KI, are nearly equal to the number of degrees that correspond to the breadth of the gore (usually 30°), multiplied by the sine of the latitude; thus, there will be found no difficulty in tracing them; but the principal difficulty proceeds from the change which those parts of the gores undergo, when they are glued upon the globe; as, in order to adjust them to the space which they ought to occupy, it is necessary to make the paper less on the sides than in the middle, because the sides are too long.

"The method employed by artists for engraving these gores, is thus described by Bion (*Usages des Globes*, tom. iii.), and by Robert de Vaugondy in the seventh volume of the Encyclopedié, and this method is sufficient for practical purposes.

"Draw on the paper a line AC, equal to the chord of 15°, to make the half breadth of the gore; and a perpendicular PC, equal to three times the chord of 30°, to make the half length: for these papers, the dimensions of which will be equal to the chords, become equal to the arcs themselves when they are pasted on the globe. Divide the height CP into nine parts, if the parallels are to be drawn in every 10°; divide also the quadrant BE into nine equal parts; through each division

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vision point of the quadrant, as G, and through the corresponding point D of the right line CP, draw the perpendiculars HGF and DF, the meeting of which in F gives one of the points of the curve BFP, which will terminate the circumference of the gore. When a sufficient number of points are thus found, trace the outline PIB with a curved rule. By this construction are given the gore breadths, which are on the globe, in the ratio of the cosines of the latitudes, supposing those breadths taken perpendicular to CD, which is not very exact; but it is impossible to prescribe a rigid operation sufficient to make a plane which shall cover a curved surface, and that on a right line AB shall make lines PA, PC, PD, equal to each other, as they ought to be on the globe. To describe the circle KDI, which is at the distance of 30° from the equator, there must be taken above O, a point that shall be distant from D the value of the tangent of 60°, which may be taken either from tables, or may be measured on a circle equal to the circumference of the globe that is to be drawn; this point will serve as a centre for the parallel DI, which ought to pass through the point D; for it is supposed equal to that of a cone circumscribing the globe, and which would touch it at the point D.

"The meridians are traced to every 10°, by dividing each parallel, as KI, into three equal parts at the points L and M, and drawing from the pole P, through all these points of division, curves which represent the intermediate meridians lying between PA and PB, such as BR and ST (fig. 15.).

"The ecliptic AQ (fig. 15.) is traced by means of the known declination, from different points of the equator, as found in the tables; for 10° it is equal to 3° 58′; for 20°=7° 50′=BQ 20; for 30°=11° 29′, &c."

In general, it is observed that the paper on which maps are printed, such as that called in France *colombier*, contracts itself $\frac{1}{72}$, or a line in six inches, upon an average, when it is dried after printing; hence it is necessary to prevent this inconvenience in engraving the gores: if, however, notwithstanding this, the gores are still found too short, it must be remedied by taking from the surface of the ball a little of the white with which it is covered; thus making the dimensions of the ball correspond to those of the gores as they are printed. But, what is singular, in drawing the gore, moistened with the paste to apply it on the globe, the axis GH lengthens, and the side AN shortens in such a manner that neither the length of the side ACK, nor that of the axis GEH of the gore are exactly equal to the quarter of the circumference of the quarter of the globe, when compared to the figure on the copper, or to the numbers shewn on the side of fig. 15.

"Mr Bonne having made several experiments on the dimensions which the gores take after being covered with paste in order to apply them to the globe, especially of the paper called *jesus*, which had been employed in covering globes of a foot in diameter; found that it was necessary to give to the gore engraved on copper the dimensions laid down in fig. 15. Supposing that the radius of the globe contains 720 parts, the half of the breadth of the gore AG=188.5; the distance AC for the parallel of 10° taken on the straight line LM is =128.1, the small deviation from the parallel of 10° in the middle of the gore ED is 4, the line ABN is a straight line, the radius of the parallel of 10° or of the circle CET, is 4083, &c. The small circular cap which is placed under H, has its radius 253, instead of 247, which it would have if the sine of 20° had been the radius of it *."

* *La Lande Astronomie*, tom. iii. p. 616. 3d ed.

Globes are made of various sizes, from a diameter of three inches, to that of as many feet; but their most usual diameter is that of 18 inches, which are sufficiently large for most of the purposes for which globes are employed. Some large globes were made about 100 years ago, in France, by P. Coronelli, a Franciscan monk, which were in considerable reputation. They were engraved, and the plates are still to be seen at Paris, at the house of M. Desnos, in the Rue St Jacques. There are some large globes at Cambridge, which were drawn by the hand; but the largest globes of which we have any account, are those which were made for the late unfortunate Louis XVI. and were kept in the palace of Marly. They were 12 feet in diameter, and we believe, are still existing at Paris, where they occupy four entire rooms, each of them being partly in an upper room, and partly in that below it, the floor of the upper room forming the horizon.

The account which we have given of the method of constructing globes, will be useful to those who purchase these instruments; but to assist them still further, we shall subjoin the following practical rules for the choice of globes.

107 Rules for choosing globes.

1. The papers should be well and neatly pasted on the globes, which may be known by the lines and circles meeting exactly, and continuing all the way even and whole; the circles not breaking into several arches, nor the papers either coming short, or lapping over one another.

2. The colours should be transparent, and not laid too thick upon the globe, to hide the names of the places.

3. The globe should hang evenly between the brazen meridian and the wooden horizon, not inclining either to the one side or the other.

4. The globe should move as close to the horizon and the meridian as it conveniently may, otherwise there will be too much trouble to find against what part of the globe any degree of the meridian or horizon is.

5. The equinoctial line should be even with the horizon all round, when the north or south pole is elevated 90° above the horizon.

6. The equinoctial line should cut the horizon in the east and west points, in all the elevations of the pole from 0 to 90°.

7. The degree of the brazen meridian marked 0, should be exactly over the equinoctial line of the globe.

8. Exactly half of the brazen meridian should be above the horizon, which may be known by bringing any of the decimal divisions on the meridian to the north point of the horizon, and finding their complement to 90° on the south point.

9. When the quadrant of altitude is placed as far from the equator, or the brazen meridian, as the pole is elevated above the horizon, the beginning of the degrees of the quadrant should reach just to the plane surface of the horizon.

10. When the index of the hour circle passes from one

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one hour to another, 15 degrees of the equator must pass under the graduated edge of the brazen meridian.

11. The wooden horizon should be made substantial and strong; it being generally observed, that, in most globes, the horizon is the first part that fails, on account of its having been made too slight.

108 In using a globe, the eastern side of the horizon should be kept towards the observer, (unless in particular problems which require a different position); and that side may be known by the word *east* on the horizon. In this position the observer will have the graduated side of the meridian towards him, and the quadrant of altitude directly before him; and the globe will be exactly divided into two equal parts by the graduated side of the meridian.

In performing some problems, it will be necessary to turn about the whole globe and horizon, in order to look at the west side; but this turning will be apt to disturb the ball, so as to shift away that degree of the globe which was before set to the horizon or meridian. This inconvenience may be avoided by thrusting the feather end of a quill between the ball of the globe and the brazen meridian, and thus, without injuring the surface of the globe, it will be kept from turning in the meridian, while the whole is moved round, so as to examine the western side.

We have already mentioned some improvements which have been made on the globes, for the purpose of remedying the defect in the old construction, of placing the hour circles on the outside of the brazen meridian. Some other improvements and modifications have been contrived by various artists; but of these we shall only mention those of Mr Senex, Mr B. Martin, Mr Smeaton, and Mr Adams.

109 Mr Senex's improvement in the globes.

Mr John Senex, F. R. S. invented a contrivance for remedying these defects, by fixing the poles of the diurnal motion to two shoulders or arms of brass, at the distance of $23\frac{1}{2}^{o}$ from the poles of the ecliptic. These shoulders are strongly fastened at the other end to an iron axis, which passes through the poles of the ecliptic, and is made to move round with a very stiff motion; so that when it is adjusted to any point of the ecliptic which the equator is made to intersect, the diurnal motion of the globe on its axis will not disturb it. When it is to be adjusted for any particular time, either past or future, one of the brazen shoulders is brought under the meridian, and held fast to it with one hand, while the globe is turned about with the other; so that the point of the ecliptic which the equator is to intersect may pass under the o degree of the brazen meridian; then holding a pencil to that point, and turning the globe about, it will describe the equator according to its position at the time required; and transferring the pencil to $23\frac{1}{2}$ and $66\frac{1}{2}$ degrees on the brazen meridian, the tropics and polar circles will be so described for the same time. By this contrivance, the celestial globe may be so adjusted, as to exhibit not only the rising and setting of the stars in all ages and in all latitudes, but likewise the other phenomena that depend upon the motion of the diurnal round the annual axis. Senex's celestial globes, especially the two greatest, of 27 and 28 inches in diameter, have been constructed upon this principle; so that by means of a nut and screw, the pole of the equator is made to revolve about the pole of the ecliptic.

To represent the above appearances in the most natural and easy manner, Mr B. Martin applied to the contrivance of Mr Senex a moveable equinoctial and solstitial colure, a moveable equinoctial circle, and a moveable ecliptic; all so connected together as to represent those imaginary circles in the heavens for any age of the world.

Improvements by Mr Smeaton.

In order to the performance of the problems which relate to the altitudes and azimuths of celestial objects, Mr Smeaton, F. R. S. has made some improvements applicable to the celestial globe; and to give some idea of the construction, they may be described as follows: Instead of a thin flexible slip of brass, which generally accompanies the quadrant of altitude, Mr Smeaton substitutes an arch or a circle of the same radius, breadth, and substance, as the brass meridian, divided into degrees, &c. similar to the divisions of that circle, and which, on account of its strength, is not liable to be bent out of the plane of a vertical circle, as is usual with the common quadrant put to globes. That end of this circular arch at which the division begins, rests on the horizon, being filed off square to fit and rest steadily on it throughout its whole breadth; and the upper end of the arch is firmly attached, by means of an arm, to a vertical socket, in such a manner that when the lower end of the arch rests on the horizon, the lower end of this socket shall rest on the upper end of the brass meridian, directly over the zenith of the globe. This socket is fitted to and ground with a steel spindle of the length, so that it will turn freely on it without shaking; and the steel spindle has an apparatus attached to its lower end, by which it can be fastened in a vertical position to the brass meridian, with its centre directly over the zenith point of the globe. The spindle being fixed firmly in this position, and the socket which is attached to the circular arch put on it, and so adjusted that the lower end of the arch just rests on and fits close to the horizon; it is evident that the altitude of any object above the horizon will be shewn by the degree which it intersects on this arch, and its azimuth by that end of the arch which rests on the horizon.

Besides this improvement, Mr Smeaton proposes that, instead of fixing the hour index, as is usually done, on one end of the axis, it be placed in such a manner that its upper surface may move in the plane of the hour circle rather than above it. To effect this, he directs the extremity of the index to be filed off so as to form a circular arc, of the same radius with the inner edge of the hour circle, to which it is made to fit exactly, and a fine line is drawn in the middle of its upper surface, to point out the hour, instead of the tapering point usually employed. By this contrivance, if the hour circle be made four inches in diameter, the time may be shewn to half a minute. For a more particular account of Mr Smeaton's improvements, we refer the reader to the 79th volume of the Philosophical Transactions.

Another improvement of the celestial globe, by which it is better adapted to astronomical purposes, is described in the article ASTRONOMY, Vol. III. p. 178.

Besides the modifications in the construction of globes, introduced by Mr Adams, and which have been already

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ready described, there are some others which we must briefly mention, respecting principally the placing the globe in an inclined position, and fitting it with a moveable or floating meridian and horizon.

The globes constructed after this manner do not hang in a frame like the ordinary globes, but are fixed on a pedestal, and supported by an axis which is inclined $66\frac{1}{2}°$ to the ecliptic, and is of course always parallel to the axis of the earth, supposing the orbit of this planet to be parallel to the ecliptic. On the pedestal below the globe is a graduated circle, marked with the signs and degrees of the ecliptic; and adjoining to this is a circle of months and days, answering to every degree of the ecliptic; and within this is a third circle shewing the sun's declination for every day of the month. There is a moveable arm on the pedestal, which being set to the day of the month, immediately points out the sun's place and declination.

Round the globe there is a circle representing the horizon of any place, and at right angles to this is fixed a semicircle, serving for a general meridian. The middle point of this semicircle serves to represent the situation of any inhabitant on the earth; for this purpose there is fixed a steel pin over the middle point of this semicircle.

Mr Adams alleges that only one supposition is necessary for performing every problem with this globe, namely, that a spherical luminous body will enlighten one half of a spherical opaque body, and consequently that a circle at right angles with the central solar ray, and dividing the globe in half, will be a terminator shewing the boundary of light and darkness for any given day. For this purpose, at the end of the moveable arm, opposite to the sun, there is a pillar, from the top of which projects a piece carrying a circle that surrounds the globe, dividing it into equal portions, and separating the illuminated from the dark parts; and 18° behind this there is another circle parallel to it, representing the limit of twilight.

There are two plates below the globe, which are turned by the diurnal revolution of the globe, each of them being divided into twice 12 hours, and on the outside being marked with the degrees of longitude corresponding to every hour; so that these circles give at sight the hour of the day at any two places on the globe, and the corresponding difference of longitude.

The celestial globe is mounted in a similar manner, except that it is fixed on the axis, and the ecliptic exactly coincides with the sun's apparent path from the earth *.

* Adams Lectures, vol. iv. p. 199.

Sect. IV. *Of the Armillary Sphere.*

112 Armillary Sphere.

If a machine be constructed that is composed only of the circles of the sphere, and made so as to revolve like a globe, a great many of the most useful problems relating to the heavenly bodies may be solved by it. An instrument of this kind is called an *armillary sphere*, and of these there are various forms. One of the most convenient is that contrived by the late Mr James Ferguson, and is thus described in his Lectures. It is represented at fig. 16.

The exterior parts of this machine are a compages of brass rings, which represent the principal circles of the heaven, viz. 1. The equinoctial AA, which is divided into 360 degrees, (beginning at its intersection with the ecliptic in Aries) for shewing the sun's right ascension in degrees; and also into 24 hours, for shewing his right ascension in time. 2. The ecliptic BB, which is divided into 12 signs, and each sign into 30 degrees, and also into the months and days of the year, in such a manner, that the degrees or points of the ecliptic in which the sun is on any given day, stands over that day in the circle of months. 3. The tropic of *Cancer*, CC, touching the ecliptic at the beginning of Cancer in *e*; and the tropic of *Capricorn* DD, touching the ecliptic at the beginning of Capricorn in *f*; each $23\frac{1}{2}$ degrees from the equinoctial circle. 4. The Arctic circle E, and the Antarctic circle F, each $23\frac{1}{2}$ degrees from its respective pole at N and S. 5. The equinoctial colure GG, passing through the south and north poles of the heaven at N and S, and through the equinoctial points Aries and Libra, in the ecliptic. 6. The solstitial colure HH, passing through the poles of the heaven, and through the solstitial points Cancer and Capricorn, in the ecliptic. Each quarter of the former of these colures is divided into 90 degrees, from the equinoctial to the poles of the world, for shewing the declination of the sun, moon, and stars; and each quarter of the latter, from the ecliptic at *e* and *f*, to its poles *b* and *d*, for shewing the latitude of the stars.

In the north pole of the ecliptic is a nut *b*, to which is fixed one end of a quadrantal wire, and to the other end a small sun Y, which is carried round the ecliptic BB, by turning the nut: and in the south pole of the ecliptic is a pin at *d*, on which is another quadrantal wire, with a small moon Z upon it, which may be moved round by hand; but there is a particular contrivance for causing the moon to move in an orbit which crosses the ecliptic at an angle of $5\frac{1}{3}$ degrees, in two opposite points called the moon's nodes; and also for shifting these points backward in the ecliptic, as the moon's nodes shift in the heaven.

Within these circular rings is a small terrestrial globe I, fixed on the axis KK, which extends from the north and south poles of the globe at *n* and *s*, to those of the celestial sphere at N and S. On this axis is fixed the flat celestial meridian LL, which may be set directly over the meridian of any place on the globe, and then turned round with the globe, so as to keep over the same meridian upon it. This flat meridian is graduated the same way as the brass meridian of a common globe, and its use is much the same. To this globe is fitted the moveable horizon MM, so as to turn upon two strong wires proceeding from its east and west points to the globe, and entering the globe at opposite points of its equator, which is a moveable brass ring let into the globe in a groove all around its equator. The globe may be turned by hand within this ring, so as to place any given meridian upon it, directly under the celestial meridian LL. The horizon is divided into 360 degrees all around its outermost edge, within which are the points of the compass, for shewing the amplitude of the sun and moon, both in degrees and points. The celestial meridian LL, passes through two notches in the north and south points of the horizon, as in a common globe; but here, if the globe be turned round, the horizon and the meridian turn with it. At the south pole of

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of the sphere is a circle of 24 hours, fixed to the rings, and on the axis is an index which goes round that circle, if the globe be turned round its axis.

The whole fabric is supported on a pedestal N, and may be elevated or depressed upon the joint O, to any number of degrees from 0 to 90, by means of the arc P, which is fixed into the strong brass arm Q, and slides in the upright piece R, in which is a screw at *r*, to fix it at any proper elevation.

In the box T are two wheels and two pinions, whose axes come out at V and U; either of which may be turned by the small winch W. When the winch is put upon the axis V, and turned backward, the terrestrial globe, with its horizon and celestial meridian, keep at rest; and the whole sphere of circles turns round from east, by south, to west, carrying the sun Y, and moon Z, round the same way, causing them to rise above and set below the horizon. But when the winch is put upon the axis U, and turned forward, the sphere with the sun and moon keep at rest; and the earth, with its horizon and meridian, turn round from west, by south, to east; and bring the same points of the horizon to the sun and moon, to which these bodies come when the earth kept at rest, and they were carried round it; shewing that they rise and set in the same points of the horizon, and at the same times in the hour circle, whether the motion be in the earth or in the heaven. If the earthly globe be turned, the hour index goes round its hour circle; but if the sphere be turned, the hour circle goes round below the index.

And so, by this construction, the machine is equally fitted to shew either the real motion of the earth, or the apparent motion of the heaven.

To rectify the sphere for use, first slacken the screw *r* in the upright stem R, and taking hold of the arm Q, move it up or down until the given degree of latitude for any place be at the side of the stem R; and then the axis of the sphere will be properly elevated, so as to stand parallel to the axis of the world, if the machine be set north and south by a small compass; this done, count the latitude from the north pole upon the celestial meridian LL, down towards the north notch of the horizon, and set the horizon to that latitude; then turn the nut *b* until the sun Y comes to the given day of the year in the ecliptic, and the sun will be at its proper place for that day; find the place of the moon's ascending node, and also the place of the moon, by an Ephemeris, and set them right accordingly; lastly, turn the winch W, until either the sun comes to the meridian LL, or until the meridian comes to the sun (according as you want the sphere or the earth to move), and set the hour index to the XII. marked noon, and the whole machine will be rectified. Then turn the winch, and observe when the sun or moon rise and set in the horizon, and the hour index will shew the times thereof for the given day.

Those who have made themselves acquainted with the use of the globes, as described in the first and second sections of this chapter, will be at no loss to perform many problems respecting the motions of the heavenly bodies by means of this sphere.

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Dr Long's sphere.

Dr Long, some years ago, constructed an armillary sphere of glass, in Pembroke hall at Cambridge. It was 18 feet in diameter, and could contain below it more than 30 persons, sitting in such a manner within the sphere, as to view from its centre the representation of the heavens drawn in its concavity. The lower part of the sphere, or that part which is not visible in the latitude of Britain, is wanting; and the whole apparatus is so contrived, that it may be turned round with as little exertion as is requisite to wind up a common jack. Dr Long has given a description of this sphere, accompanied with a figure, in his Astronomy.

The invention of the armillary sphere is thought by La Lande to be as ancient as that of astronomy itself. It has been attributed to Atlas, to Hercules, to Anaximander, and Musæus; while others have supposed that it originated in Egypt. The sphere of Archimedes, which became so celebrated, appears to have been something like that of Dr Long, as it was certainly composed of a globe of glass, which, besides containing the circles of the sphere, served as a planetarium, and represented the motions of the planets. Claudian has celebrated it in some beautiful lines. See Archimedes.

A combination of the armillary sphere with a planetarium was constructed by the late Mr George Adams, and is figured in Plate XIII. fig. 1. of his Astronomical and Geographical Essays.

Chap. III. *Of the Construction and Use of Maps and Charts.*

Sect. I. *Description of Maps and Charts.*

114
Distinction of maps and charts.

It has been seen, that the surface of the earth may be delineated, in the most accurate manner, on the surface of a globe or sphere. This mode of delineation, however, can be employed only for the purpose of representing the general form and relative proportions of countries on a very confined scale; and is, besides, from its bulk and figure, not well suited to many of the purposes of the geographer. To obviate these inconveniences, recourse has been had to maps and charts, or delineations of the earth's surface on a plane; where the form and boundaries of the several countries, and the objects most remarkable in each, whether by sea or land, are represented according to the rules of perspective, so as to preserve the remembrance that they are parts of a spherical surface. In this way, the several countries or districts of the earth may be represented on a larger scale, and delineations of this kind admit of more easy reference.

115
Description of a map.

In maps, the circles of the sphere, and the boundaries of the countries within them, are drawn as they would appear to an eye situated in some point of the sphere, or at a considerable distance above it. In maps of any considerable extent of country, the meridians and parallels of latitude are circular lines, but, if the map represents only a small district, as a province or county, those circles become so large, that they may, without any considerable error, be represented by straight lines. In charts, which are also called *hydrographical maps*, as they are representations rather of the water than land, the meridians and parallels are usually represented by straight lines, crossing each other at right angles, as in the smaller maps; and, in particular parts, there are drawn lines diverging from several points, in the direction of the points of the compass, in order to mark the

the bearings of particular places. In maps, the inland face of the country is chiefly regarded in the delineation; but in charts, which are designed for the purposes of navigation, the internal face of the land is left nearly blank, and only the sea coast, with the principal objects on it, such as churches, light-houses, beacons, &c. are accurately delineated; while particular care is taken to mark the rocks, shoals, and quicksands in the sea, that may endanger the safety of vessels; the depths or soundings of the principal bays and harbours, and the direction of the winds, where these are stationary or peculiarly prevalent. Another distinction of maps and charts is, that in the former, the sea-coast is shaded on the side next the land, while, in the latter, it is shaded towards the sea.

In maps the upper side represents the north, the lower side the south; that on the right hand the east, and that on the left hand the west. All the margins of the map are graduated; the upper and lower showing the degrees of longitude, and the right and left margins the degrees of latitude. (See fig. 1. to which the reader must refer in going over the following description). If the map is on a small scale, only every ten degrees of longitude or latitude are marked on the margin; but, if the map is drawn on a large scale, every degree is numbered, and sometimes every half degree is marked with the number 30 in smaller figures. The space included between every two degrees in small maps, or between every two degrees in those on a larger scale, is usually divided into ten spaces, which are alternately left blank, and marked with parallel lines, to denote the subdivisions of single degrees or minutes. Through every ten degrees of latitude a line is drawn, representing a parallel of latitude; and through every ten degrees of longitude, or at smaller intervals in each, where the size of the map will admit of it, there are drawn lines representing meridians. In some maps these lines are continued from side to side, or from top to bottom, across both sea and land; but in other maps, they are sometimes only drawn across the sea. The first meridian, however, and the principal circles of the sphere, as the equator, tropics, &c. should always be drawn directly across the map. In most maps, it is marked on the margins whether the longitude is east or west, and the latitude north or south; but, if this is not marked, it may easily be known, by observing towards what part of the map the degrees increase. If the degrees of latitude increase from the lower to the upper part of the map, the country delineated lies in north latitude; but if they increase from above downwards, it lies in south latitude. Again, if the degrees of longitude increase towards the right, the countries are in east longitude; but if towards the left, they are in west longitude.

The principal objects that diversify the face of the country delineated in the map, such as rivers, mountains, forests, lakes, roads, cities, towns, forts, &c. are marked in such a manner as that they may be most easily distinguished. A river is denoted by a black crooked line, drawn very fine towards the source or head of the river, and gradually becoming broader as it approaches towards the mouth; and the lesser rivers or rivulets, which unite their waters with those of their principal stream, are denoted by similar lines appearing to branch off from the first.

Mountains are represented by the figures of little hills; and if these figures are placed in a row, they denote a ridge of mountains running across the land. If a mountain is a volcano, it is denoted in the map by the appearance of smoke issuing from its summit. Woods or forests are represented by a number of little trees or shrubs, placed in a group. Lakes are denoted by a circumscribed spot shaded with dark lines, and bogs or fens by a more regular spot of the same kind, more lightly shaded, or, where the map is coloured, painted of a light green. Roads are represented in a map by two straight lines drawn parallel to each other, for the principal roads, or by a single straight line for the lesser or cross roads. Cities are denoted by a large house, or the figure of a church with the steeple in the middle; and if the city is the metropolis of the country, this is denoted by a white circular space in the middle of the house or church. Small towns are usually represented by circles; and where a small church with the steeple at one end occurs, it denotes a parish. Where the map is on a large scale, or represents only a small district, the towns are denoted by a group of small houses, or more commonly by a number of small shaded spots on each side of the road. A fort, castle, or fortified town, is denoted by a semicircular space surrounded by an angular edge representing bastions. The shoals upon the coast are represented by small dots; the depth of water in bays and harbours by figures, denoting the number of fathoms, among which is sometimes drawn the figure of an anchor, to shew that in that place there is good anchorage for ships.

The boundaries or limits that divide countries from each other are distinguished in maps by dotted lines drawn round each country or district, in such a direction as to shew its proper form. Where the map is coloured, the countries or districts are distingnished from each other by the side of the boundary next each being shaded by a different colour from that of the adjoining. Thus, in a map of Europe the boundary of France may be shaded green, that of Spain red, that of Italy yellow, that of Germany blue, &c. In one corner of the map there is usually drawn a scale divided into a number of equal parts, by which the number of miles or leagues, from one part of the map to another may be measured. Sometimes the parts into which the scale is divided are used to denote geographical miles, of 60 to a degree; but more commonly they correspond to the miles in use in the country where the map is made, as in Britain, to British statute miles of $69\frac{1}{4}$ to a degree.

To mark more distinctly the bearings of different parts of the map, there is usually added in some blank space a circle with four radii, marking the four cardinal points of the compass; the north point being distinguished by the figure of a *fleur de lis*, and the east point by a cross.

Till of late, the only distinction between the land and water in maps and charts, was afforded by the shading of the sea-coasts, as mentioned above. In this way, however, the eye cannot easily and expeditiously distinguish the form and extent of the land; and, where the shading is carried much beyond the boundary of the coast, as is often done, especially in engraving small islands, the land is made to appear much larger than it really is.

The ingenious Mr Wilson Lowry having lately contrived an instrument for engraving parallel straight lines, in a much more clear and commodious way than

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than could be done by the common graver, it occurred to Mr Pinkerton, while preparing his Modern Geography, that this invention might be applied with advantage to the improvement of maps. A set of maps was accordingly engraved by Mr Lowry for Pinkerton's Geography, in which the water was marked by dark parallel lines to discriminate it from the land. These lines are drawn horizontally; and Mr Pinkerton proposed that, in engraving charts, the land should be marked with similar lines drawn in a perpendicular direction, while the water should be left blank. This improvement has since been adopted by other constructors of maps and charts, and bids fair to be generally used. The effect is pleasing; and the progress of instruction will be greatly facilitated by the new method, as the extent and bearings of the several countries are seen, as it were, with a glance of the eye. In many of these maps which we have seen, however, the lines are drawn too strongly, which renders the sea so dark, that the names of islands and places on the sea coast can with difficulty be perused. As the line of coast in these maps is strongly marked, the parallel lines denoting the sea should be engraved in a light and soft style; and in this way Mr Lowry's first specimens are executed.

Sect. II. *Of the Construction of Maps and Charts.*

116 Construction of maps.

The construction of maps consists in making a projection of the surface of the globe on the plane of some one of its circles, supposing the eye to be placed in some particular point. The describing of these projections depends on the principles of perspective, and the projection of the sphere. The general principles will be explained under those articles, but the particular mode of drawing maps properly forms a part of the present treatise.

The methods of constructing maps vary according to the size or scale of the map, and to the projection employed in constructing it.

117 Orthographic projections.

There are three projections employed in constructing maps, the *orthographic*, the *stereographic*, and the *globular*. In the orthographic projection the eye is supposed to view the part of the globe to be projected, from an infinite distance. In this projection the parts about the middle of the map are very well represented, but those towards the margin are too much contracted.

118 Stereographic projections.

In the stereographic projection, the eye is supposed to be situated in the surface of the globe to be represented, and looking towards the opposite surface. This is the method usually employed in constructing most maps, especially maps of the world, or planispheres.

In constructing a map of the world, as well as most partial maps, the part of the sphere to be represented is supposed to be in the position of a right sphere (see N° 90.). In this mode of projection, the hemisphere to be represented is supposed to be delineated on the plane of that meridian by which it is bounded, in the same manner as its concave surface, conceiving the sphere to be transparent, would appear to an eye placed in the opposite hemisphere, where the equator crosses a meridian; that is 90° distant from that which forms the plane of the projection. In a delineation of this kind, the meridians and parallels of latitude are represented by arches of circles, except the equator and the central meridian, which are straight lines; and each parallel or meridian forms an arc of a greater circle, in proportion as it approaches nearer to the centre of the map.

By either of these projections only half the globe can be represented in one projection; but in the map of the world, the two hemispheres are usually drawn on the plane of the same circle, adjacent to each other. By Mercator's projection, usually employed for charts, and to be described presently, the whole globe may be represented in one projection, but much distorted.

If the projection of a map of the world be formed on the plane of a meridian, the two projections will represent the eastern and western hemispheres of the globe.

When the projection is made on the plane of the equator, in the situation of a parallel sphere, the projections represent the northern and southern hemispheres, which appear as their concave surface would be seen by an eye placed at the opposite pole. In this way the meridians become straight lines diverging from the same centre, and the parallels are circles having the same common centre.

The following is the method of constructing a map of the world, on the plane of a meridian, according to the globular projection. (See fig. 17.).

11[9] Globular projection of a map of the world.

About the centre C, with any radius as CB, describe a circle, representing the meridian that is to form the plane of the hemisphere. Draw the diameters NS, and AB, crossing each other at right angles, and the former of these will be the central meridian, and the latter the equator. Divide each semidiameter into nine equal parts, and divide each quadrant of the circle also into nine equal parts, each of which will be equal to 11°. If the scale of the map be sufficiently large, each of these may again be divided into ten equal parts or degrees. The next object is to describe the meridians passing through every 10° of the equator. Suppose we are to draw the meridian of 80° west of Greenwich. We have here three points given, the two poles and the point 80° on the equator, and it is easy to describe a circle that shall pass through these three points. This arch will be the meridian. The method of drawing a circle through any three points is, in this case as follows: About the centre S, with the radius SC, describe a circular arch, as XX; and about the centre N, with the same radius, describe the arch ZZ; then about the centre 80° with the same distance, describe arches 1, 1, 2, 2, crossing the former, and draw lines from 2 to 1 on each side of AB, crossing each other, and AB produced, in D. D is the centre of the circular arc, representing the meridian of 80° west from Greenwich; and with the same radius the meridian of 130° west longitude may be drawn. All the other meridians are to be drawn in a similar manner by describing a circular arch through three points N, S, and the required degree. (See Geometry).

For describing the parallels, suppose that of 60° N. Lat.; about the centre O, with any radius, describe the circle FGH, and about the points 60°, 60°, in the primitive circle, with the same distance, describe the arcs *cc*, *dd*, cutting the circle FGH: through the points of intersection draw straight lines, and the point where these lines meet in NS produced, as in I, is the centre of the arch that will represent the parallel of 60°. The other parallels are drawn in a similar manner, observing that the first circle, such as FGH, must have for its centre that point in the central meridian through which the parallel is to be drawn. Fig. 18. represents this projection

projection with all the meridians and parallels completed.

If the map is very large, and the paper on which it is to be drawn does not admit of so many circles, the centres of the meridians and parallels are more easily found in the following manner. Having divided the semi-diameters and quadrants, each into 9 equal parts, find, from a scale of equal parts, the length of the half chord of each arc, and the versed sine of half the same arc; then add together the square of the half chord, and the square of the versed sine, and divide the sum by the versed sine; the quotient is equal to the diameter, and $\frac{1}{2}$ of this to the radius of the circle required. In this manner the radii of all the meridians and parallels may be found.

As, in drawing maps on a large scale, compasses of an ordinary size will not answer for describing the circular arcs, it is convenient to have some other mechanical contrivance for this purpose; and it is found that a thin flexible ruler of tough wood, called a *bow*, may be so bended as to form a curve, very nearly circular, that will pass through the three points that are to determine the meridian or parallel. In this way the circles on maps on a large scale are usually drawn by engravers and students of geography, and where the circle is of very large radius, the method is sufficiently accurate; but it ought by no means to be employed where compasses of a proper size can be procured, or conveniently used.

The following is the method given by Dr Hutton, for describing a globular projection of the earth on the plane of the equator. For the north or south hemispheres draw AQBE, for the equinoctial (fig. 19.), dividing it into the four quadrants EA, AQ, QB, and BE; and each quadrant into 9 equal parts, representing each 10° of longitude; and then from the points of division, draw lines to the centre C, for the circles of longitude. Divide any circle of longitude, as the first meridian EC, into 9 equal parts, and through these points describe circles from the centre C, for the parallels of latitude, numbering them as in the figure. In this method equal spaces on the earth are represented by equal spaces on the map, as nearly as any projection will bear; for a spherical surface can in no way be represented exactly upon a plane. Then the several countries of the world, seas, islands, sea-coasts, towns, &c. are to be entered in the map, according to their latitudes and longitudes.

To draw a Map of any particular Country.

124 Construction of particular maps.

There are three methods of doing this.

1st, For this purpose its extent must be known as to latitude and longitude; as suppose Spain, lying between the north latitudes 36° and 44°, and extending from 10° to 23° of longitude, so that its extent from north to south is 8°, and from east to west 13°.

Draw the line AB for a meridian passing through the middle of the country (fig. 20.), on which set off 8° from B to A, taken from any convenient scale; A being the north and B the south point. Through A and B draw the perpendiculars CD, EF, for the extreme parallels of latitude. Divide AB into eight parts, or degrees, through which draw the other parallels of latitude parallel to the former.

For the meridians, divide any degree in AB into 60 equal parts, or geographical miles. Then, because the length in each parallel decreases towards the pole, from the table shewing this decrease given in p. 514. take the number of miles answering to the latitude of B, which is $48\frac{1}{2}$ nearly, and set it from B, seven times to E, and six times to F; so is FF divided into degrees. Again, from the same table take the number of miles of a degree in the latitude A, viz. $43\frac{1}{6}$ nearly; which set off from A, seven times to C, and six times to D. Then from the points of division in the line CD, to the corresponding points in the line EF, draw so many right lines for the meridians. Number the degrees of latitude up both sides of the map, and the degrees of longitude on the top and bottom. Also in some vacant place make a scale of miles, or of degrees, if the map represent a large part of the earth; to serve for finding the distances of places upon the map.

Then make the proper divisions and subdivisions of the country; and having the latitudes and longitudes of the principal places, it will be easy to set them down in the map; for any town, &c. must be placed where the circles of its latitude and longitude intersect. For instance, Gibraltar, whose latitude is 36° 11′, and longitude 12° 27′, will be at G; and Madrid, whose latitude is 40° 10′, and longitude 14° 44′, will be at M. In the same manner the mouth of a river may be set down; but to describe the whole course of the river, the latitude and longitude of every turning, and of the towns and bridges by which it passes, must also be marked down. The same is necessary for woods, forests, mountains, lakes, castles, &c. The boundaries are described by setting down the remarkable places on the sea coast, and drawing a continued line through them all. This method is very proper for small countries.

2d *Method.* Maps of particular places are but portions of the globe, and may therefore be drawn in the same manner as the whole globe, either by the orthographic or stereographic projection of the sphere. But in partial maps a more easy method is as follows. Having drawn the meridian AB in the last figure, and divided it into equal parts as before, draw lines through all the points of division; put them together to AB, to represent the parallels of latitude. Then to divide these, set off the degrees in each parallel; diminish after the manner directed for the two extreme parallels CD and EF, and through all the corresponding points draw the meridians, which will be curved lines; these were right lines in the last method, because only the extreme parallels were divided according to the table. This method is proper for a large tract, as Europe, &c. in which case the parallels and meridians need be drawn only through every 5° or 10°. This method is much used in drawing maps, as all the parts are nearly of their due magnitude, except being a little distorted towards the outside, from the oblique intersection of the meridians and parallels.

3d *Method.* Draw PB of a convenient length, for a meridian; divide it into nine equal parts, and through the points of division, describe as many circles for the parallels of latitude, from the centre P, which represents the pole. Suppose AB (fig. 21.) the height of the map; then CD will be the parallel passing through the greatest latitude, and EF will represent the equator. Divide the equator EF into 9 equal parts of the same size as those in AB, both ways beginning AB; divide

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divide also all the parallels into the same number of equal parts, but lesser, in proportion to the numbers for the several latitudes, as directed in the last method for the rectilineal parallels. Then through all the corresponding divisions draw curved lines which will represent the meridians, the extreme meridians being EC and FD. Lastly, number the degrees of latitude and longitude, and place a scale of equal parts, either in miles or degrees, for measuring distances.

When the place of which a map is to be made is but small, as when a county is to be delineated, the meridians will be so nearly parallel to one another, and the whole will differ so little from a plane, that the map may be laid down in a much more easy manner than what is given above. It will be here sufficient to measure the distances of places in miles, and note them down in a plane rectangular manner. The method of delineating such partial maps is the province of the surveyor. See SURVEYING.

121 Mercator's projection.

Mercator's projection is chiefly confined to charts for the purposes of navigation. In this projection the meridians, parallels, and rhumbs, are all straight lines; but instead of the degrees of longitude being everywhere equal to those of latitude, as is the case in plain charts, the degrees of latitude are increased as we approach towards either pole, being made to those of longitude in the proportion of radius to the sine of the distance from the pole, or cosine of the latitude, or, what is the same thing, in the ratio of the secant of the latitude to radius. Hence all the parallel circles are represented by equal and parallel straight lines, and all the meridians are parallel lines also; but these increase indefinitely towards the poles.

From this proportional increase of the degrees of the meridian, it is evident that the length of an arc of the meridian beginning at the equator is proportional to the sum of all the secants of the latitude; or that the increased meridian bears the same proportion to its true arc as the sum of all the secants of the latitude to as many times the radius. The increased meridian is also analogous to a scale of the logarithmic tangents, though this is not at first very evident. It is not certain by whom this analogy was first discovered, but the discovery appears to have been made by accident. It was first published and introduced into the practice of navigation by Mr Henry Bond, by whom this property is mentioned in an edition of Norwood's Epitome of Navigation, printed about 1645. This analogy, though it had been found true by actual measurement, was not accurately demonstrated. Nicholas Mercator offered to disclose, for a sum of money, a method which he had discovered for demonstrating it; but this was not accepted, and the demonstration was, we believe, never disclosed. See *Nicholas* MERCATOR. About two years after, however, the demonstration was again discovered, and published by James Gregory.

The meridian line in Mercator's scale is a scale of logarithmic tangents of the half colatitudes. The differences of longitude on any rhumb, are the logarithms of the same tangents, but of a different species; those species being to each other as the tangents of the angles made with the meridian. Hence any scale of logarithmic tangents is a table of the differences of longitude, to several latitudes, upon some one determinate rhumb; and therefore as the tangent of the angle of such a rhumb is to the tangent of any other rhumb, so is the difference of the logarithms of any two tangents, to the difference of longitude on the proposed rhumb, intercepted between the two latitudes, of whose half complements the logarithmic tangents were taken.

It was the great study of our predecessors to contrive such a chart in plano, with straight lines, on which all or any parts of the world might be truly set down, according to their longitudes and latitudes, bearings, and distances. A method for this purpose was hinted at by Ptolemy, near 2000 years since, and a general map, in such an idea, was made by Mercator: but the principles were not demonstrated, and a ready way shown of describing the chart, till Wright explained how to enlarge the meridian line by the continual addition of secants, so that all degrees of longitude might be proportional to those of latitude, as on the globe; which renders this chart, in several respects, far more convenient for the navigator's use, than the globe itself, and which will truly shew the course and distance from place to place, in all cases of sailing.

For further particulars respecting the construction, and for the use of charts, see NAVIGATION.

In choosing maps, it is proper to examine particularly whether the curved lines of those that ought to have the meridians and parallels arches of circles be truly circular. If the map is composed of more than one sheet, the sheets should be so joined together as that the corresponding meridional lines and parallels be each in one continued line. The colours in painted maps, as was observed with respect to globes, should be fine and transparent, and not laid on too thickly.

Maps folded for the pocket answer very well for travelling, in so far as they point out the relative situation of places; but owing to the intervals at which the parts are pasted on the canvas, the distances between places cannot be ascertained with any degree of accuracy.

SECT. III. *Of the use of Maps.*

Maps are of great utility in the study of geography and history; and if they are accurately drawn, many of the problems that are usually performed on the globes, may be solved mechanically by means of maps.

In consulting a map, it is not sufficient to find out in it the name of the place of which you desire to know the situation, although this is frequently all at which the consulter of a map aims: it is, besides, proper for the student to inform himself respecting the relative position of the place, with regard to its vicinity to other places; its bearings and distance from the principal places in the same or neighbouring districts; whether it is near the sea-shore, and is near a convenient harbour; whether it be seated on some principal river, and on what side of the river; whether it is in the neighbourhood of a considerable canal; whether it be near a lake, mountain, forest, &c. and many other little particulars that will readily suggest themselves to an attentive reader.

The problems that are usually performed by means of maps, are the following.

PROBLEM I. *To find the latitude and longitude of any given place.*

1[illegible] Use of Maps.

In maps on a large scale, or where the meridians and parallels of latitude are straight lines, the latitude of the place

place may be easily found by stretching a thread over the place, so that it may cross the same degree of latitude on each side of the map; and the degree crossed will be the latitude required. Or, with a pair of compasses measure the shortest distance of the place from the nearest parallel, and apply this distance to either side of the map, so as to keep one point of the compasses on the same parallel; then the other point will shew the degree of latitude as measured on the graduated margin, counting from the parallel north or south, according as the place is in north or south latitude.

The longitude of the place may be found in a similar manner, by stretching the thread over the place, or laying a ruler across it, so as to cut the same degree of longitude on the top and bottom of the map, and that is the degree required.

The above methods answer very well in plain charts or in maps of counties; but when the meridians and parallels are curved lines, we must find how often the distance of the place, measured by the compasses from the nearest parallel, will reach the next parallel in a straight direction, and from thence the latitude may be found with sufficient exactness. Thus, suppose we are required to find the latitude of Berlin, the capital of Prussia. The nearest parallel is that of 50° north latitude; the distance of Berlin from this parallel will reach the parallel of 60° in four times, measuring on the map of Europe. The fourth part of ten, or two and a half, added to 50, gives the latitude required, or $52\frac{1}{2}$.

To find the longitude on such maps, measure how often the distance of the place from the nearest meridian will reach the next meridian. Thus, in the same instance, the distance of Berlin from the meridian of 10, which is the nearest towards the east, taken three times, will extend a little beyond the meridian of 20. Add to 10 the third part of this distance, which is about three and a half, and we have 13° 30′ for the longitude of Berlin east from London.

Problem II. *The latitude and longitude of a place being given; to find the place on the map.*

Where the meridians and parallels are straight lines, this is done by stretching one thread from the given latitude on one side of the map to the same latitude on the other side; while another thread is stretched between the corresponding degrees of longitude. The intersecting point of the two threads shews the place required. Thus, suppose we are required to find the place whose latitude is 34° 29′ S. and longitude 18° 23′ E. Stretching one thread between the given latitudes, and another between the given longitudes, we shall find that they cross over the Cape of Good Hope, which is therefore the place required.

When the meridians and parallels are curved lines, the most accurate way will be to describe a circle of latitude through the given degree of latitude on each side, and a circle of longitude through the corresponding degrees of longitude, and the intersection of these circles will shew the place. An easier method will be, knowing between what two parallels of latitude and longitude the place lies, and consequently by what four lines it is bounded, to find the place by trial, by considering the proportional distance of it from each line.

Problem III. *The latitude of a place being given; to find all those places on the same map that have the same latitude.*

If a parallel of latitude happen to be drawn on the map through the given place, this problem is easily solved, by tracing along the parallel, and seeing what other places it passes through. If a parallel is not drawn through the given place, take with a pair of compasses the distance of the place from the nearest parallel; then keeping one foot on the parallel, and the other in such a position as to describe a line parallel to the parallel of latitude, move the compasses, and all the places over which the point that is not on the parallel passes, have the same latitude with the given place.

This method will not succeed in maps on which a large tract of country is delineated on a small scale.

Problem IV. *Given the longitude of a place; to find on the map all those places that have the same longitude.*

Find the longitude of the given place, and if a meridian passes through it, observe all the places that lie under this meridian; or, if a meridian does not pass through the place, find by the compasses, as in the last problem, those places that are situated at the same parallel distance with the given place from the nearest meridian. These places have nearly the same longitude with the given place.

Problem V. *To find the antœci of a given place.*

Find the latitude and longitude of the place by Problem I. and find another place of the same longitude, whose latitude is equal to that of the former, but in a contrary direction. The inhabitants of this latter place are the antœci to the latter.

Ex. Suppose a ship to be in the Indian ocean, in lat. 13° S. and long. 80° E. it is required to find the antœci to her present situation? *Ans.* The place which has nearly the same longitude, and an equal latitude in a contrary direction, viz. 13° N. is Madras.

Problem VI. *To find the periœci of a given place.*

Find the longitude of the given place, and subtract it from 180°: the remainder will be the longitude in an opposite direction of the periœci. Then find a place having an equal longitude with this last, and having the same latitude with that of the given place: this latter is the situation required.

Ex. It is required to find the periœci to the inhabitants of the gulf of Siam. *Ans.* The longitude of Siam is 100° 50′ E. which, subtracted from 180°, leaves 79° 10′ W. Now, the place that has this longitude, and the same latitude with Siam, viz. about 14° N. is the isthmus of Darien.

Problem VII. *To find the antipodes of a given place.*

This problem is solved on maps in the same manner as on the globe.

Problem VIII. *Having the hour at any place given; to find what hour it is in any part of the world.*

Find the difference of longitude between the two places, and reduce this to its equal value in time, by

Principles and Practice.

N° 65. Add this value to the given hour, if the place where the time is required be to the eastward of the given place, and the sum is the time required. If the place at which the time is required lie to the westward of the given place, subtract the difference of longitude in time from the given hour, and the difference is the time sought.

Note.—If, after adding, the sum is found greater than 12, 12 must be cancelled, and the hours must be changed from A. M. to P. M. and *vice versa;* and if, on subtracting, the difference in time between the two places happens to be greater than the given hour, 12 must be added to the given hour, and the hours changed as before mentioned.

Ex. Suppose it to be at present 9 A. M. at Lisbon, what time of the day is it at Pekin in China? *Ans.* The difference of longitude between Pekin and Lisbon is 125° 33′, which reduced to time gives 8 hours 22 minutes; and since Pekin lies to the east of Lisbon, this must be added to 9, the given hour, giving a sum of 17 hours, 22 minutes; but as this is greater than 12, we must take 12 away, and the difference, 5 hours 22 minutes, changed from morning to afternoon hours, is the time required. It is therefore 22 minutes past five P. M. at Pekin.

PROBLEM IX. *To find those places in the torrid zone to which the sun is vertical on any given day.*

Find in an ephemeris, or nautical almanack, the sun's declination for the given day; then observe, in the map of the world, all those places which lie under that parallel of latitude, which is the same with the declination, and these will be the places required.

Ex. It is required to find at what places the sun will be vertical on the 20th of March and 23d of September? *Ans.* The sun's declination on the 20th of March, is 19′ S. and on the 23d of September 6′ N. Now the principal places that lie near the parallel of 19′ S. and 6′ N. are the island of St Thomas, the middle part of the islands of Sumatra and Borneo; the Gallipagos isles, and Quito in South America.

123 Analemma for solving geographical problems.

The Analemma, or Orthographic Projection delineated in Plate CCXXXV. will solve many of the most curious problems, and with the assistance of maps will be almost equivalent to a terrestrial globe. The parallel lines drawn on this figure represent the degrees of the sun's declination from the equator, whether north or south, amounting to $23\frac{1}{2}$ nearly. On these lines are marked the months and days which correspond to such and such declinations. The size of the figure does not admit of having every day of the year inserted; but by making allowance for the intermediate days, in proportion to the rest, the declination may be guessed at with tolerable exactness. The elliptical lines are designed to shew the hour of sunrising or sunsetting before or after six o'clock. As 60 minutes make an hour of time, a fourth part of the space between each of the hour-lines will represent 15 minutes; which the eye can readily guess at, and which is as great exactness as can be expected from any mechanical invention, or as is necessary to answer any common purpose. The circles drawn round the centre at the distance of $11\frac{1}{4}$ each, shew the point of the compass on which the sun rises and sets, and on what point the twilight begins and ends.

In order to make use of this analemma, it is only necessary to consider, that, when the latitude of the place and the sun's declination are both north or both south, the sun rises before six o'clock, between the east and the elevated pole; that is, towards the north, if the latitude and declination are north; or towards the south, if the latitude and declination are south. Let us now suppose it is required to find the time of the sun's rising and setting, the length of the days and nights, the time when the twilight begins and ends, and what point of the horizon the sun rises and sets on, for the Lizard point in England, Frankfort in Germany, or Abbeville in France, on the 30th of April. The latitude of these places by the maps will be found nearly 50° N. Place the moveable index so that its point may touch 50° on the quadrant of north latitude in the figure; then observe where its edge cuts the parallel line on which April 30th is written. From this reckon the hour-lines towards the centre, and you will find that the parallel line is cut by the index nearly at the distance of one hour and 15 minutes. So the sun rises at one hour 15 minutes before six, or 45 minutes after four in the morning, and sets 15 minutes after seven in the evening. The length of the day is 14 hours 30 minutes. Observe how far the intersection of the edge of the index with the parallel of April 30th is distant from any of the concentric circles, which you will find to be a little beyond that marked two points of the compass, and this shews that on the 30th of April the sun rises two points and somewhat more from the east towards the north, or a little to the northward of east-north-east, and sets a little to the northward of west-north-west. To find the beginning and ending of the twilight, take from the graduated arch of the circle $17\frac{1}{2}$ degrees with a pair of compasses; move one foot of the compasses extended to this distance along the parallel of April 30th, till the other just touches the edge of the index, which must still point at 50. The place where the other foot rests on the parallel of April 30th, then denotes the number of hours before six at which the twilight begins. This is somewhat more than three hours and a half, which shews that the twilight then begins soon after two in the morning, and likewise that it begins to appear near five points from the east towards the north. The uses of this analemma may be varied in a great number of ways; but the example just now given will be sufficient for the ingenious reader.

SECT. IV. *Of the Origin and Progress of Maps.*

1 Origin of maps.

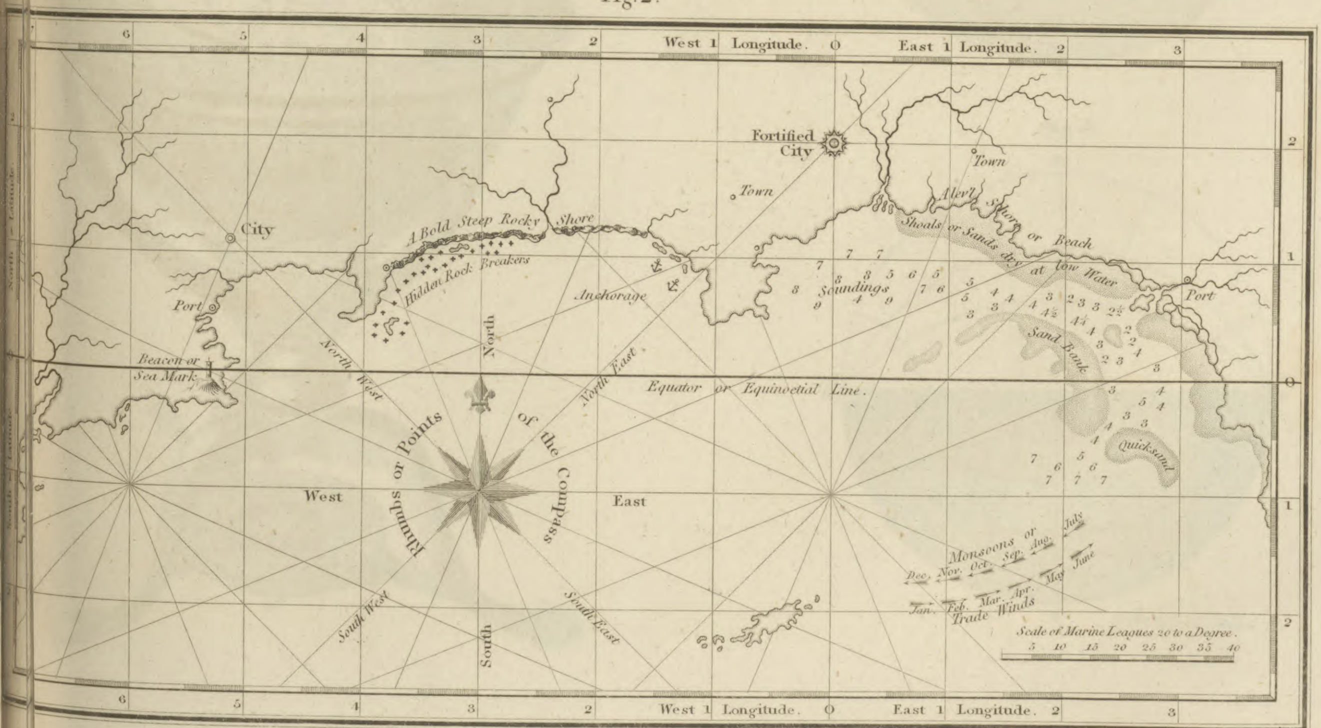
The first map of which we have any certain record, is that of Anaximander, about 560 years before the Christian era. This is mentioned by Strabo, book i. and is supposed to be that referred to by Hipparchus, under the name of the ancient map.

It has been alleged, that Sesostris, king of Egypt, on his return from his boasted expedition, after having traversed great part of the earth, recorded his march in maps, of which he gave copies, not only to the Egyptians, but to the Scythians, to the great admiration of both people. This is the relation of Eustathius; but M. Montucla considers it as a very improbable story, and thinks that the invention of maps cannot be dated prior to Anaximander *. Some have supposed that the Jews laid down the holy land in a map, when they distributed

* Mont. Hist. Math. tom. i. p. 6.

Fig. 1.

Fig. 2.



Published by A. Constable & Co. Edinburgh 1819.

Sidy Hall, Sculp.

Fig. 3.

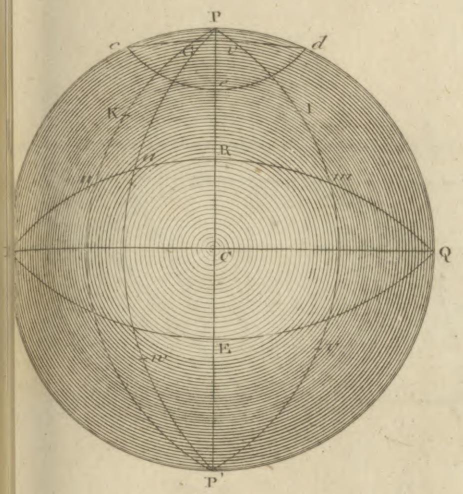


Fig. 4.

Fig. 6.

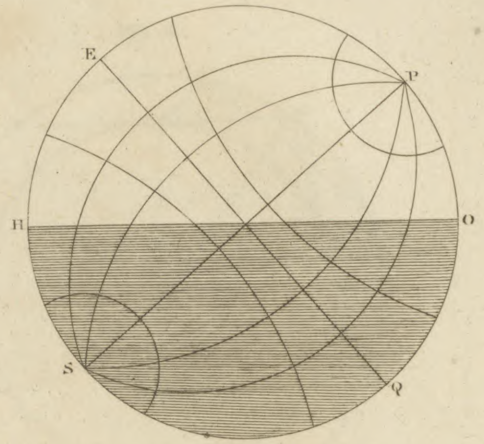


Fig. 7.

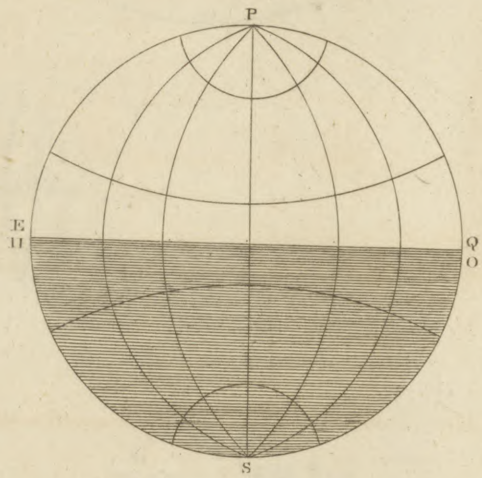
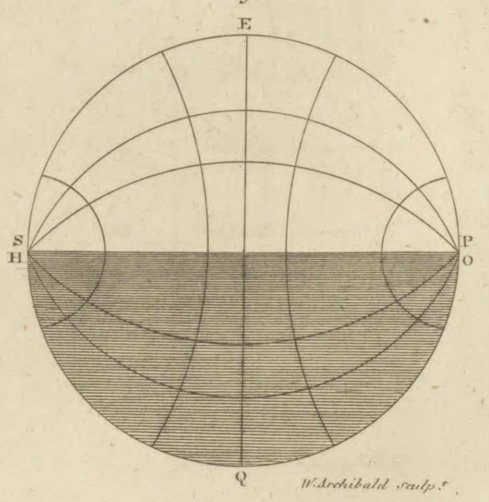


Fig. 5.

Fig. 8.



W. Archibald sculp.

Fig. 9.

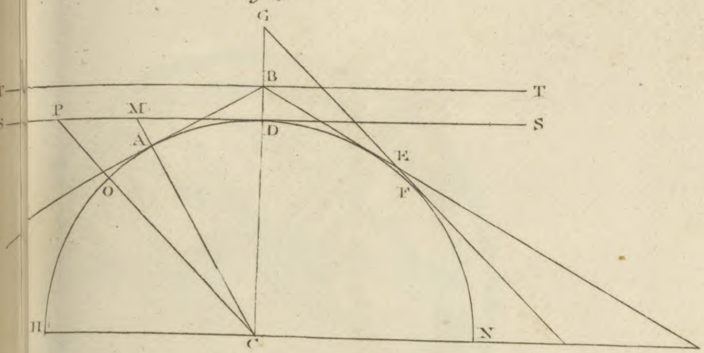


Fig. 10.

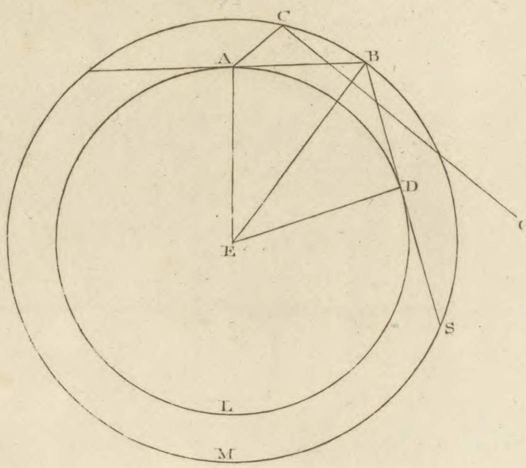


Fig. 11.

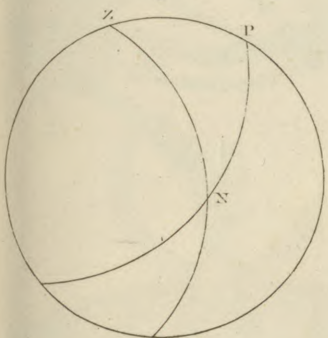


Fig. 12.

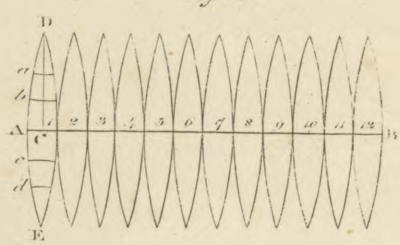


Fig. 13.

Fig. 14.

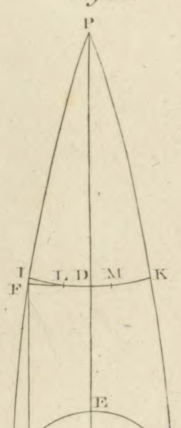
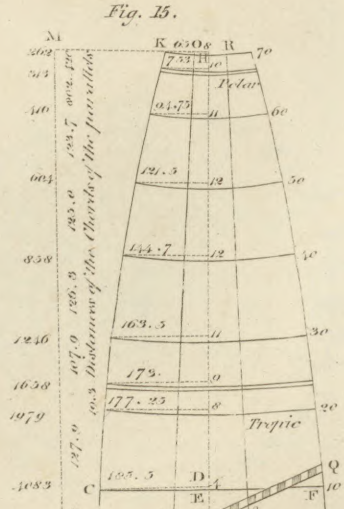


Fig. 15.



W. Archibald Sculp.

Fig. 16.

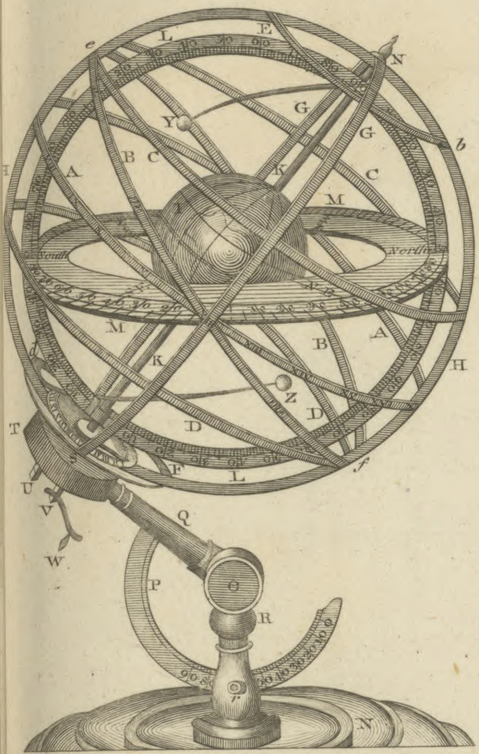


Fig. 17.

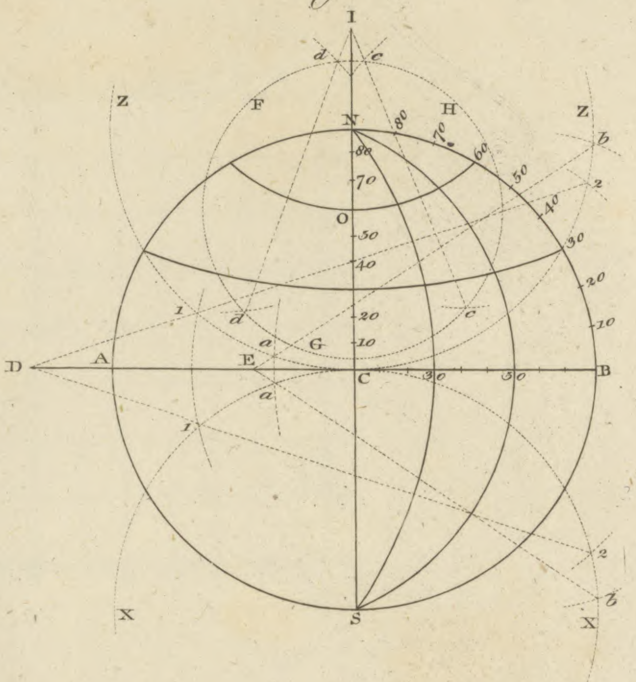


Fig. 18.

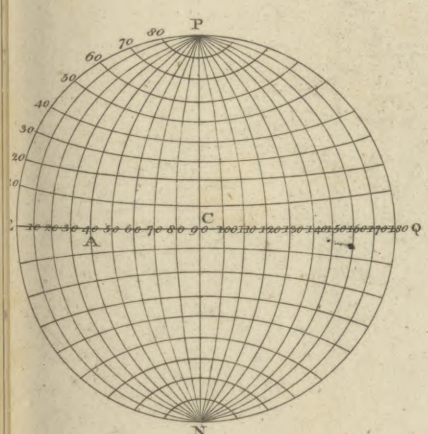
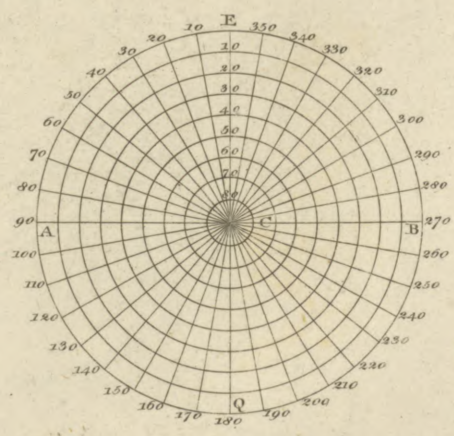


Fig. 19.



A. Bell Prin. Wal. Sculptor fecit.

Fig. 20.

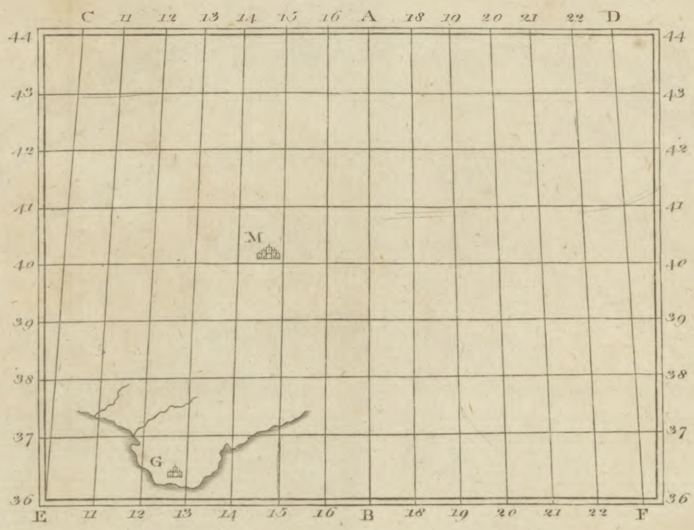
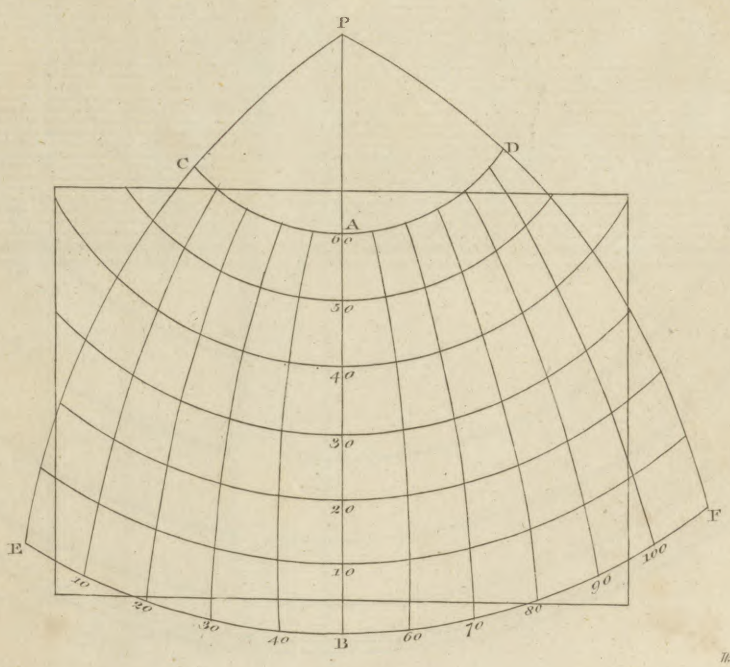
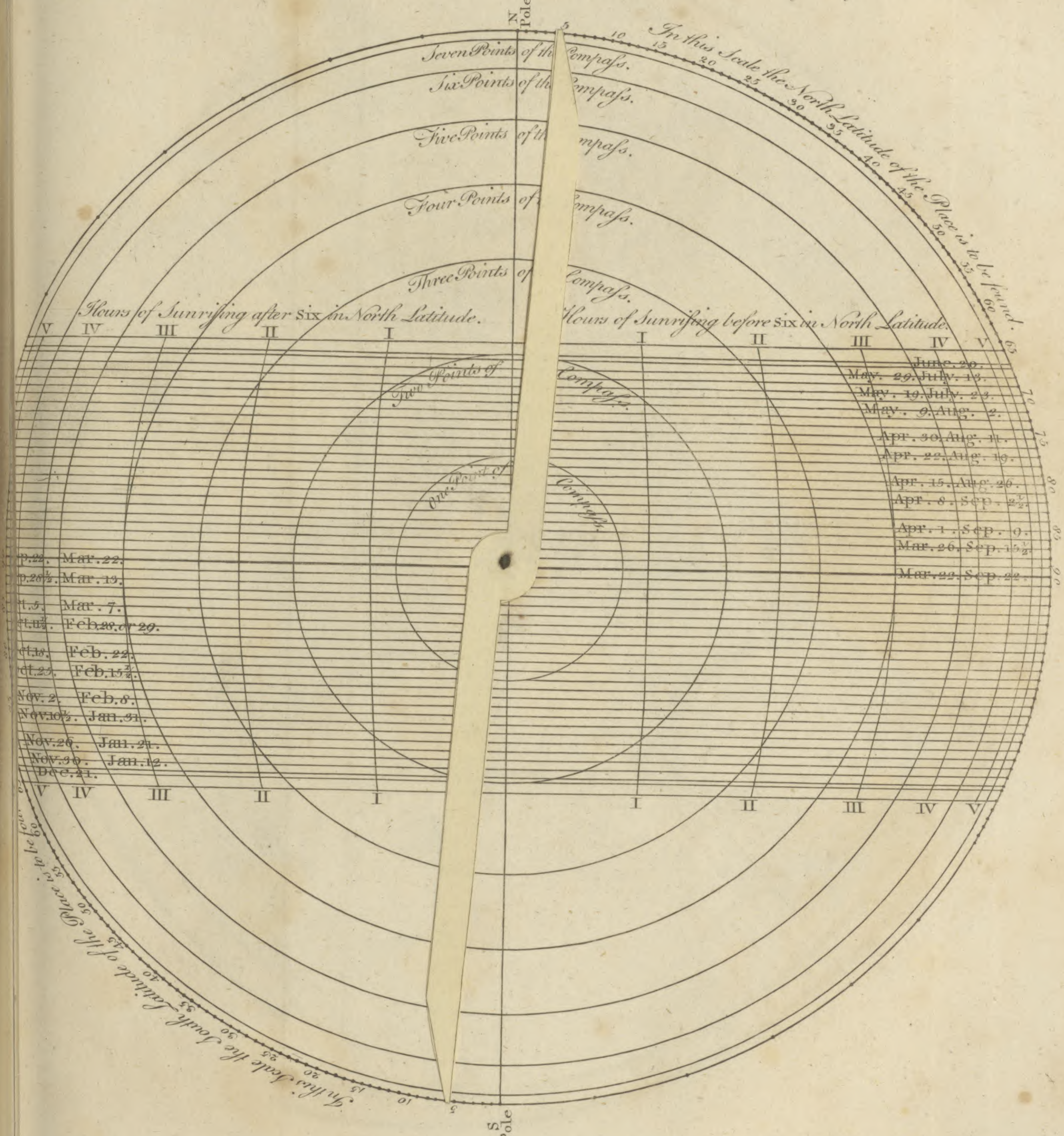


Fig. 21.

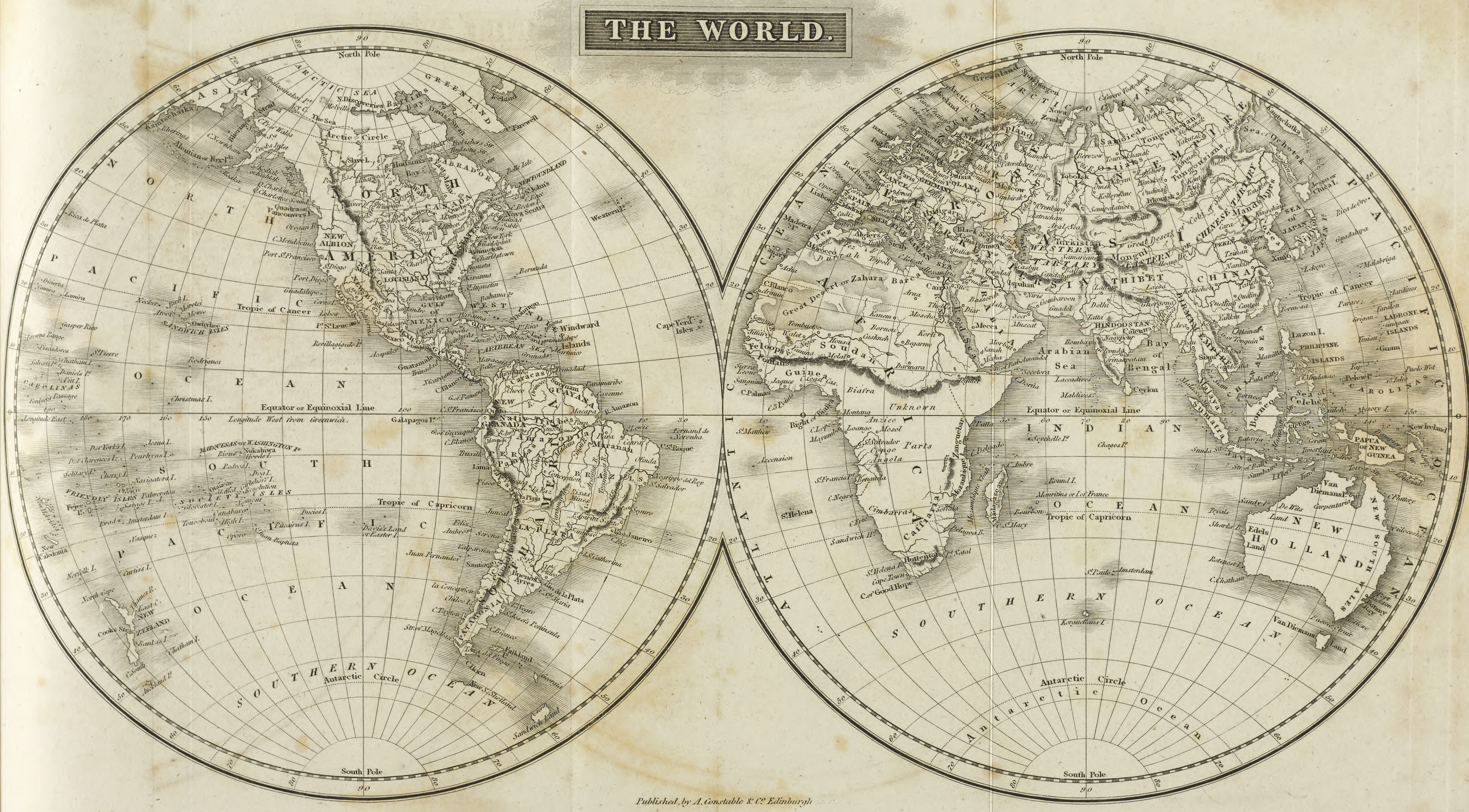


W. Archibald Sculp.t

An Analemma, Shewing the time of Sun rising & Sun setting, the length of the Days & Nights, and the point of the Compass on which the Sun rises & sets, for every Degree of Latitude, and for every Degree of the Suns North or South declination.



A. Bell Prin. Wal. Sculptor fecit.


THE WORLD.
North Pole
South Pole
NORTH AMERICA
SOUTH AMERICA
PACIFIC OCEAN
SOUTHERN OCEAN
Antarctic Circle
Tropic of Cancer
Tropic of Capricorn
Equator or Equinoxial Line
Longitude West from Greenwich
ATLANTIC OCEAN
AFRICA
INDIAN OCEAN
NEW HOLLAND
Antarctic Ocean
Published, by A. Constable & Co. Edinburgh


North Pole
South Pole
ARCTIC OCEAN
Spitsbergen
Nova Zemla
Lapland
Petersburg
Moscow
Simbirsk
Astrachan
Aral Sea
Perm
Tobolsk
Berezow
Omsk
Samoieda
Tongousians
Yakutsk
Ostiaks
Kolleywane
Semipalatnoi
Irkoutsk
Sea of Ochotsk
Kamtschatka
RUSSIAN EMPIRE
ASIA
Turkistan
WESTERN TARTARY
Samarcand
Great Desert
Mongul
EASTERN OR CHINESE TARTARY
Mandshurs
SEA OF JAPAN
JAPAN
Corea
PEKIN
Yellow Sea
Nankin
CHINA
THIBET
Lassa
PERSIA
Ispahan
Delhi
Gombaroon
HINDOOSTAN
Calcutta
Bombay
Ava
BIRMAN EMPIRE
Canton
Formosa
Tropic of Cancer
Hainan
Siam
Cambodia
Luzon I.
PHILIPPINE ISLANDS
Manilla
Arabian Sea
Bay of Bengal
Socotora
Laccadives
Maldives
Ceylon
Malaya
Sumatra
Borneo
Sea of Celebes
Celebes
Palawan
Batavia
Java
Sunda Str.
Timor
Ceram
PAPUA OR NEW GUINEA
New Ireland
LADRONE ISLANDS
Guam
CAROLINAS
Equator or Equinoxial Line
INDIAN OCEAN
Seychelle Is.
Chagos Is.
Madagascar
Mauritius or I. of France
Bourbon
Round I.
Tropic of Capricorn
Van Diemans L.
Carpentaria
De Wits Land
Edels Land
NEW HOLLAND
NEW SOUTH WALES
Port Jackson
Botany Bay
Sharks B.
Rotenest I.
C. Chatham
St. Paul
Amsterdam
Kerguelans I.
SOUTHERN OCEAN
Van Diemans Land
Bass's Strait
Antarctic Circle
Antarctic Ocean
PACIFIC OCEAN
Rica de Plata
Rica de Oro
Guadalupa
Malabriga
Jardines
Gasper Rico
Browns Range
St. Pierre
Chatham I.
Longitude East
FRIENDLY ISLES
Fejee Is.
New Caledonia
Norfolk I.
North Cape
Cooks Str.
NEW ZEALAND

Published by A. Constable & Co. Edinburgh 1819.

Engraved by Sidy Hall, Bury Str. Bloomsby.

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Principles and Practice.

tributed the different portions to the nine tribes at Shiloh; a supposition which is derived from Joshua's account, that they were sent to walk through the land, and that they described it in seven parts in a book. Josephus also relates, that when Joshua sent people from the different tribes to measure the land of promise, he sent with them men well skilled in geometry. All this, however, is no proof that these persons drew a sketch of the country, according to our idea of a map; but probably only wrote down, for the satisfaction of their employers, the extent, boundaries, and general characteristics of the divisions of the land.

Herodotus has given a minute description of a map constructed by Aristagoras, tyrant of Miletus, an abridgement of which will serve to give some notion of the maps of those times. It was drawn upon brass or copper, and seems to have been merely an itinerary containing the route through the countries which were to be traversed in a march which Aristagoras proposed to Cleomenes, king of Sparta, for the purpose of attacking the king of Persia at Susa, that he might thus assist in restoring the Ionians to their liberty. The rivers Halis, Euphrates, and Tigris, which, according to Herodotus, must have been crossed in that expedition, were laid down in this map; and it contained one straight line, called the royal road or high way, which comprehended all the stations or places of encampment, from Sardis, the beginning of the route, to Susa, a distance of 13,500 stadia, or 1687½ Roman miles of 5000 feet each. The number of encampments in this whole route was 111.

Ptolemy of Alexandria, the celebrated geographer mentioned in N° 21. constructed maps to illustrate his description of places, and these are the first that have regular meridians and parallels, the better to define and determine the situation of places. Ptolemy acknowledges that his maps, with the addition of some improvements of his own, the principal of which was certainly the introduction of meridians and parallels, were copied from previous maps made by Marianus Tyrius, &c. They are, however, often very inaccurate.

According to Atheneus, a work which seems to have contained maps, was written by Baeton, under the title of Alexander's march; and a work on the same subject is mentioned as the production of Amynthus. We are informed by Pliny, that this Baeton was one of the surveyors of Alexander's marches; and he quotes the exact number of miles of these marches, according to Baeton's mensuration, and confirms their authenticity by the letters of Alexander. Pliny also remarks, that a copy of this conqueror's surveys was given by Zenobius, his treasurer, to the geographer Patrocles, who was admiral of the fleets of Seleucus and Antiochus.

Peutingerian table.

Among the most celebrated of the ancient maps, are the Peutingerian tables, so called, because published by Peutinger of Augsburg. These tables contain an itinerary of the whole Roman empire; all places except seas, wood, and deserts, being laid down according to their measured distances, though without any mention of latitude, longitude, or bearing. A particular description of this monument of antiquity is given in the 18th volume of the History of the Academy of Inscriptions, and in the History of the Academy of Sciences for 1761, from which M. Montucla has dawn up the following acconnt. The map of Peutinger, as it is in the original in the imperial library, is exactly one French foot in height, and 20 feet eight inches in length, according to measures taken by Buache, from a copy of the splended edition given by Scheele in 1753. It comprehends the whole extent of the Roman empire, from Constantinople to the ocean, and from the shores of Africa to the northern parts of Gaul; but the table which it affords of this vast extent of country is by no means calculated to give us an idea of its figure, since the 35° of longitude which it comprehends, occupy 20 feet 8 inches, while the 13° of latitude are comprised within the space of one foot; thus the countries represented are so disfigured, that the Mediterranean appears only like a broad river, and all the countries are so distorted, towards the north and south, that they cannot be recognised.

Most of those who have seen this ancient map, have considered it as the rude and bungling work of a man little conversant with geography, and still less so with mathematics; but Edmund Brutz considers the distortion of this map as similar to what we see in some pieces of perspective, and that it ought to be examined from some certain near point in order to perceive the objects in their natural proportion.

Buache supposed long ago, that this map was constructed with more scientific skill than it appears to be at the first glance; and that the apparent irregularities which we observe in it, might have been introduced designedly, for the purpose of deriving greater advantages as to what was intended for the principal object. In fact, as the Roman routes extended almost entirely from east to west, they paid more attention to the measures in this direction than those between north and south; and the map in this way might have had the greater convenience of being more easily rolled up, and consequently more portable.

Thus far Buache hazarded no more than conjecture; but a labour undertaken by him with a very different view, led him to the true design of the map of Peutinger. He had been tracing a scale of climates, and of the length of the days and nights, for the purpose of attaching it to small maps of the different countries of Europe. As the space occupied by the scale was pretty much extended in height, but had very little breadth, he formed the idea of drawing a kind of map upon two scales, one pretty much extended for the latitude, and the other very much contracted for the longitudes, preserving the hollows of the coasts and boundaries of each state. As this disposition of his map strangely disfigured the countries which it was intended to represent, he was led to imagine that this map might be the reverse of that of Peutinger. This was sufficient to engage him to construct another map upon the same principle; but in which the scale of longitudes was much greater than that of the latitudes. He then saw that he had been right in his supposition, and that the map which he had last constructed had a considerable resemblance to that of Peutinger. This latter is in fact only a plain chart, constructed upon two scales, of which that of the longitudes is very great, and that of the latitudes much smaller.

One difficulty alone arose. By supposing that he observed in this map a custom at present established among geographers, of representing the meridians by lines drawn perpendicular to the base of the chart, and the parallels

Principles and Practice.

parallels to the equator by straight lines drawn parallel to this same base, Buache found a considerable error. The bottom of the gulf of Venice and Rome did not then appear, as they ought to do, under the same meridian. He soon, however, saw the solution of this difficulty. The method of drawing the meridians parallel to the sides of the chart, is a matter of pure agreement, and had probably not been observed in the map of which we are speaking. The ancient Roman geographers having considered that Italy was naturally divided by the Appenines, according to its length, into two parts that were nearly equal, had therefore delineated the length of Italy from Trent to the end of the peninsula, parallel to the lower margin of the map, and had afterwards arranged the other parts which the map was to contain, conformably to this disposition; and as the length of Italy is not in a direction parallel to the equator, it would happen necessarily that the meridians and parallels, if they had been drawn on this map, would have been parallel neither to the sides nor to the lower margins of the map, and that the vertical line passing through Rome must intersect the gulf of Venice at about the middle: but this line is not a meridian.

Thus, this map is not so rude a work as has been imagined, but has been entirely constructed according to rule; and it even appears that the author had employed pretty good materials in its compilation, as the positions are laid down in a manner that differs little from modern observation *.

* *M. Montucla*, tom. iv. p. 599.

From the time of Ptolemy till about the 14th century, no new maps were published; and the first maps of any esteem among the moderns were constructed by Mercator, to whom we are indebted for the projection according to which marine charts are constructed. Mercator was followed by Ortelius, who undertook to construct a new set of maps with the modern divisions of countries and names of places, for want of which the maps of Ptolemy were become almost useless. After Mercator and Ortelius, many others published maps, which were chiefly copied from those above mentioned, till about the middle of the 17th century, when Blaeu published his large atlas, or *Cosmographie blaviane*, in which is a pretty accurate description of the earth, the sea, and the heavens, comprised in 12 folio volumes. About the same time an atlas in two folio volumes was published in France by M. Sanson, the maps of which are in general very correct, containing many improvements of the travellers of those times. The maps of Blaeu and Sanson were copied with little variation both in England, France, and Holland, till from later observations De Lisle, Robert, Wall, &c. published still more accurate and copious sets of maps.

The works of recent travellers and navigators have considerably improved the construction and accuracy of our maps and charts; but there is still much to be done, especially with respect to trigonometrical surveys, before any high degree of correctness can be acquired. Among the latest maps and charts, those constructed by Mr Arrowsmith are in the greatest estimation.

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Catalogue of the best maps.

As a collection of good and accurate maps is of the greatest importance in the study of geography and history, we shall here subjoin a list of some of the best modern maps that have been published.

Those maps which may be collected for the purpose of forming an atlas, have been arranged under three heads, according to their size, or the extent of their scale. 1st, Those which consist of more than six sheets, such as De Bouge's map of Europe in 50 half sheets, and Cassini's map of France in 183 sheets. 2dly, Those from six to four sheets, to which class belong several maps of kingdoms. And, 3dly, Those from one sheet to four, which is the smallest size that can answer the purpose of an atlas. We shall briefly notice the best maps of each size.

Planispheres, or *Maps of the World*.—We know of no very large map of the world that can at present be confidentially relied on: the best is that of Mr Arrowsmith in four sheets; and Faden has published very good maps in one sheet.

Maps of Europe.—1st Size. That of De Bouge, published at Vienna, or that by Sortzmann in 16 sheets, which is the better of the two. 2d Size. Arrowsmith's in four sheets. 3d Size. That by Faden in one sheet.

Maps of England.—I. The trigonometrical surveys of the counties, published by Lindley and Gardner, and by Faden. II. Cary's atlas of the counties, and his England and Wales in 81 sheets. III. Faden's map in one sheet.

Maps of Wales.—I. That of Evans in nine sheets. III. The maps in Pennant's Tours, and Evans's Cambrian Itinerary.

Maps of Scotland.—I. The surveys of the several counties. II. Ainslie's nine sheet map. III. An excellent map by General Roy, and Ainslie's reduced map, in one sheet.

Maps of Ireland.—I. Survey of counties. III. A valuable map by Dr Beaufort, in two sheets, or Faden's in one sheet.

Maps of France.—I. Cassini's mentioned above, and the *atlas nationale*, in 85 sheets. III. Faden's one sheet map, and a map, in departments, by Bellycime, in four sheets.

Maps of the Netherlands.—I. Ferran's map in 25 sheets. II. *Atlas de Department Belgique*. III. Ferrari's map reduced by Faden.

Maps of Holland.—II. Kep's maps of the United Provinces. III. Faden's map of the Seven United Provinces in one sheet.

Maps of Germany.—II. Chauchard's map of Germany. III. A map of the Austrian dominions, in one sheet, by Baron Lichtenstern.

Maps of Prussia.—I. Sortzmann's atlas in 21 sheets. III. Sortzmann's reduced, in one sheet.

Maps of Spain.—Lopez's atlas, not, however, very accurate. II. A map of Spain in nine sheets by Montelle and Chanlaire. III. Faden's map in one sheet.

Maps of Portugal.—II. Geoffry's improved by Rainsford, in six sheets. III. De la Rochette's chorographical map in one sheep, published by Faden.

Maps of Italy.—I. The maps of the several states. III. D'Anville's map of Italy improved by De la Rochette, in four sheets, published by Faden.

Maps of Turkey in Europe.—III. Arrowsmith's map of Turkey in two sheets. De la Rochette's map of Greece in one sheet.

Maps of Switzerland.—I. Weiss's atlas, published at Strasburg in 1800. III. Weiss's reduced map in one sheet.

Maps of Denmark.—I. Maps of the provinces, under the direction of Bygge. III. Faden's maps of Denmark, Sweden, and Norway, in one sheet.

Maps

Maps of Sweden.—I. Atlas of the Swedish provinces, by Baron Hermelin. III. De la Rochette's, by Faden, in one sheet.

Maps of Asia.—The best general map of Asia is that by Arrowsmith in four sheets, published in 1801; and D'Anville's, in six sheets, may still be consulted with advantage.

There are few good maps of the individual countries; but the following are esteemed among the best.

Of China.—D'Anville's atlas, and a map by Arrowsmith.

Of Tartary.—A map by Witsen, in six sheets, and one by De Witt in one sheet.

Of Japan.—Robert's map in one sheet.

Of the Birman Empire.—The maps published in Mr Symes's embassy.

Of Hindostan.—Rennell's map in four sheets. His atlas of Bengal, and his map of the southern provinces.

Of Persia.—La Rochette published a beautiful map to illustrate the expedition of Alexander the Great; and a good modern map has been published by Mr M'Donald Kinneir.

Of Arabia there are some good partial maps in Niebuhr's journey.

Of the Asiatic Islands there is an excellent chart by Arrowsmith, in four sheets.

Of Australasia, or *New Holland*, the best drawing is contained in Arrowsmith's chart of the Pacific ocean.

Maps of Africa.—The best general map of Africa is still that of D'Anville, though some little additions may be made to it, derived from the journeys of Park and Brown. Major Rennell's partial maps may be consulted with advantage.

Of Abyssinia there is a good map in Bruce's travels.

Of Egypt, the best maps are that of the Delta by Niebuhr, and that of Lower Egypt by la Rochette.

Of the Mahometan States, the best maps are those by Shaw, and a chart of the Mediterranean in four sheets, by Faden.

Of the Cape of Good Hope, the best is Barrow's survey.

Maps of America.—There is no modern general map of America that can be relied on. The best is that of D'Anville, in five sheets, published in 1746 and 1748.

Mr Arrowsmith has published an excellent map of North America, on a very large scale, but has omitted the Spanish dominions.

Of the United States, the best map is Arrowsmith's in four sheets, published in 1802; and a good map, including the recent states, was published by Mr Mellish in 1816.

Of the British Possessions in America, besides Arrowsmith's map above mentioned, there is a good map of Upper Canada by Smith, in one sheet.

Of the West India Islands, the best map is that of Jefferys in 16 sheets, from which a smaller one in one sheet has been reduced.

Of South America, the best map is that published by Faden in 1799, in six sheets, from an engraving done at Madrid some years before.

APPENDIX.

27 Observation on the study of geography.

BEFORE we conclude this article, we must make a few observations on the method to be followed for acquiring or imparting geographical knowledge.

As some knowledge of geography, as well as of chronology, is absolutely necessary, before history can be properly understood, the rudiments of these sciences should be learned, as soon as the capacity of the pupil will allow. It happens fortunately, that some of the most useful parts of geography, those which consider the relative situations, extent and boundaries of countries, with the manners and customs of their inhabitants, are highly interesting; and provided that a knowledge of them be conveyed to a child in a pleasing manner, they are well fitted to interest his curiosity, and awaken his attention. The more scientific parts of geography, and a detailed account of the minute circumstances respecting each country, though extremely useful, and indeed necessary to the more advanced student, may be withheld for a little without any great loss, till his age and judgment permit him to see their utility and application.

In teaching geography to very young children, their chief attention should be directed to those circumstances which are most interesting; and even with this limited view much may be learned at a very early period. For this purpose the dissected maps that are usually sold at toy shops, may be employed with considerable advantage; but it is to be regretted, that the maps used in preparing these are seldom taken from the most correct copies. Those works also which, under the disguise of fictitious voyages and travels, are intended to convey a geographical knowledge of various countries, afford a very pleasing and profitable method of instruction. A late work of this kind, by M. Jaufret, entitled *the Travels of Rolando*, may be advantageously put into the hands of young people; and, as they are farther advanced, the travels of Anacharsis the younger by the abbé Barthelemi will give them considerable information respecting the manners, customs, and historical events of ancient Greece.

When the young student is sufficiently advanced to prosecute the study of geography on a more extensive and scientific plan, it would be desirable that he should begin by reading some elementary treatise on astronomy, such as that of Mr Bonnycastle, or the *Spectacle de la Nature*; or, if he has acquired a proper degree of mathematical knowledge, he may read Laplace's *Systeme du Monde*, the astronomical part of *Robison's Mechanical Philosophy*, or the astronomical article in this dictionary.

It may happen, that, from a defect of early education, or want of time, a preliminary course of astronomy cannot be commanded. Still, however, considerable progress may be made in geography, by the mechanical means of maps and globes. The student should, therefore, provide himself with a pair of the best globes, chosen according to the directions laid down in N° 107; and with a few good maps of those countries which are most interesting, particularly maps of Europe, Asia, Africa, and North and South America, the British islands, France, Germany, Italy, Russia, and Denmark, which may be collected from the list given at N° 126.

Being provided with these materials, the student should first read over Chap. I. of Part II. of this treatise, or a similar part of some elementary work in geography. On the elementary principles of geography we would recommend the general principles prefixed to Mr Patteson's general and classical Atlas; and for teaching the use of the globes, Bruce's Introduction to Geography and Astronomy. For a complete account of modern geography we cannot refer to a better work than that of Mr Pinkerton; and for a combined account of ancient and modern geography, the pupil may have recourse to a work on that subject by Dr Adam of Edinburgh.

After reading over the preliminary part above mentioned, the pupil may go through the second Chapter of Part II. solving all the problems as he goes along on the terrestrial globe; and thus he may proceed progressively through the whole article, leaving that part of Part I. which treats of the history of geography for the last object of his enquiry.

In studying the particular circumstances of each country, the pupil should always have the map of the country before him; and, as he goes along, should trace there the situation of each particular place; of the principal mountains, lakes, the sources and directions of the rivers, the form and bounding of the shores, &c. In his progressive view of particular geography, it will be proper for the pupil to begin with the country in which he resides; and, after having made himself master of that, to proceed successively to those which border on it, or whose connection with it is the most interesting.

Thus an inhabitant of these islands, after having taken a view of EUROPE in general, should make himself acquainted with BRITAIN and IRELAND (by perusing the articles ENGLAND, SCOTLAND, and IRELAND in this Dictionary or in other works); whence he may proceed to FRANCE and its dependencies in the NETHERLANDS, SWITZERLAND, ITALY; thence to GERMANY and the AUSTRIAN territories, PRUSSIA, SWEDEN, DENMARK, and RUSSIA; whence he may return to the south of Europe to SPAIN, PORTUGAL, and TURKEY, &c. After Europe, the United States of AMERICA will probably be found the most interesting; the pupil may therefore study the geography of NORTH AMERICA before that of ASIA. From ASIA he may proceed to AUSTRALASIA and POLYNESIA; thence to AFRICA, and so conclude with SOUTH AMERICA. Nothing will contribute more to the advancement of geographical studies than the construction of maps. If the pupil has time therefore he should early be instructed in this part of the subject by at first drawing a map of the world according to the directions laid down in N° 118. then one of Europe, and so of other quarters and countries. In constructing this map, it will be proper first to lay down those places which are near the coast, in order to form the outline of the maritime part of the country, and only the most remarkable places inland, especially those which are situated in the course of the principal rivers. In every map the most prominent features of the country, as the mountains, lakes, rivers, and principal cities and towns, should first be attended to, and from these the pupil may be introduced to the other places in the order of their magnitude or importance.

The most agreeable and interesting method of studying particular geography, after having become acquainted with the elementary principles of the science, would be to peruse the best books of voyages and travels; for from those, where the traveller can be depended upon, the most correct systems of geography are compiled. Many of these, however, are too prolix and particular to be put into the hands of most young people, and a judicious abridgement of the best of them will answer every purpose; and perhaps Dr Mavor's collection may be recommended, as the best of the kind in the English language. For those whose time and convenience will admit of their reading the best writers of voyages and travels, there is no want of such works; and Mr Pinkerton has given at the end of his excellent work, a list of the best in most languages. We shall here only notice a few of the best and latest.

Pennant's Tours in Britain.
Young's Tours in the British isles.
Saintfond's Travels in England and Scotland.
Young's Travels in France.
Holcroft's Tour in France.
Spallanzani's Travels in the two Sicilies.
Cox's Travels in Russia, &c.
Pallas's Travels in the Russian empire.
Carr's Northern Summer.
Staunton's Account of China.
Barrow's Travels in China.
Percival's Account of Ceylon.
Syme's Embassy to Ava.
Collins's Account of New South Wales.
Bruce's Travels in Abyssinia.
Barrow's Travels in Africa.
Park's Travels in the interior of Africa.
Brown's Travels in Africa.
Sonnini's Travels in Egypt.
Percival's Cape of Good Hope.
Mackenzie's Journey in North America.
Davis's Travels in America.
Mackinnon's Tour in the West Indies; with the voyages of Anson, Byron, Cook, Phipps, Bligh, Wilson, Wallis, La Peyrouse, &c. &c.

INDEX.

Problems

GEOLOGY.

INTRODUCTION.

Introduction.

1 Definition and object of geology.

THAT part of natural history which treats of the internal structure of the earth, as far as we have been able to penetrate below its surface; of the arrangement of the materials of which it is composed, and of the changes which have taken place in these, is called GEOLOGY, from γη, the *earth*, and λόγος, *a discourse*. This science has been called by Werner, GEOGNOSY, and is by him defined to be *that part of mineralogy which considering minerals as a part of our globe, treats chiefly of their bearings and positions with respect to each other* (A). Till of late this department of literature was called physical geography, but at present the terms GEOLOGY and GEOGNOSY are generally adopted; of these we have preferred the former, as being equally expressive and more familiar; under this head we propose to include every thing that is usually comprehended under what have been called *theories of the earth*.

GEOLOGY differs from COSMOGONY as a *part* from the

(A) Werner has probably made this trifling change from a desire of novelty; and some of his admiring pupils have attempted to display in very pompous but puerile terms, that it is of great value and importance.

Introduction.

the whole; the object of the latter is to give an account of the creation of the *universe*, while the former confines itself to the consideration of the planet which we inhabit.

Geology is intimately connected with mineralogy, and may indeed be said to depend on this as its very foundation. Werner, as we have seen, considers *Geognosy* as a part of *Mineralogy;* but we are disposed to concur with Mr Kirwan, who, speaking of mineralogy with respect to its relation to geology, calls it "the alphabet of the huge and mysterious volume of inanimate nature."

Definition.

Geology may be divided into descriptive and speculative; the former giving a general account of the materials of which the globe is composed, and of their arrangement; while the latter is strictly confined to what may be called a theory of the earth, or an attempt to explain the manner in which the structure and arrangement have been brought about, and the changes that have taken place in the disposition of the component parts of the earth.

Importance of the science

The science of geology is of considerable importance in many points of view.

to the naturalist;

1. The student of natural history cannot but derive a great fund of profit and advantage from a science, which makes him acquainted with so large a department of nature. Mineral bodies, whether we consider them as individuals of nature, or as collected into those masses which form the strata of the earth, and the mountains that rise above its surface, are peculiarly interesting to the naturalist, as well from the variety of form and beauty of appearance which some of them present, as the useful purposes to which many of them are applied. The other kingdoms of nature delight us with the display of order and design exhibited in their organization, or interest us from the intimate connexion which subsists between many of them and ourselves. These are objects of the *beautiful;* while the stupendous mountain, the awful volcano, the towering cliff, the gloomy mine, and the majestic cavern, are objects of the *grand* and the *sublime.*

to the miner

2. To the miner, and all those who are employed in searching the bowels of the earth for the treasures which they contain, geology, as well as mineralogy, forms an essential qualification. Experience has shewn that certain minerals and metals are found more frequently attached to some of the stony materials of the earth than to others, and that a few of them are only found in particular strata. Examples of this kind will be given presently. We have also learned that the arrangement of the materials in the earth is so far regular and uniform, that when we know the particular materials near which certain metals and minerals are commonly found, and the usual disposition in these places; and when we find in another situation the same materials disposed in a similar manner, we are pretty certain that the metal or mineral of which we are in search is not far distant. We are therefore encouraged to prosecute the search with every probability of success. Those who undertake to direct an investigation of this kind, or to carry on the operations requisite for the obtaining what is sought, would do well to inform themselves beforehand of such facts as are well established respecting the distribution of the materials of the earth, and the substances usually found connected with them. For want of this necessary information, we often see projectors impose on the credulity, and impoverish the finances, of gentlemen of landed property, who are led to suppose that they possess on some part of their estate a rich vein of metal, seam of coal, &c. the working of which will considerably improve their income.

6 to the landed proprietor;

3. The failure of undertakings of this kind, partly from the villany of the projector, and partly from the ignorance of his employer, shews the advantages that gentlemen of landed estates would derive from the study of geology. An acquaintance with this science would guard them against the artifices of designing men, and prevent them from embarking in uncertain and expensive projects, the issue of which is too often ruin and disappointment.

7 and to the Christian.

4. But the study of geology boasts a still higher advantage. Nothing has more contributed to demonstrate the truth of the divine writings, and to clear up many doubtful passages in them, than the discoveries that have lately been made in the structure and formation of the earth. The original state of the globe is so intimately connected with that which it at present exhibits, that we cannot properly understand the latter without referring to the former; and recent experience has shewn that the obscurity in which the philosophical knowledge of this subject was involved, has been highly favourable to those systems of atheism and infidelity which prevailed in the last age. Much of this obscurity is now removed; and the investigations of Whitehurst, Werner, Kirwan, Howard, and some other geologists, by proving that the supposition of a deluge is the only hypothesis on which we can account for the present state of our globe, have contributed as much to the advancement of true religion as of philosophical knowledge.

"So numerous indeed, and so luminous, have been the more modern geological researches, and so obviously connected with the object we have now in view, that since the obscuration or obliteration of the primitive traditions, strange as it may appear, no period has occurred so favourable to the illustration of the original state of the globe as the present, though so far removed from it. At no period has its surface been traversed in so many different directions, or its shape and extent under its different modifications of earth and water been so nearly ascertained, and the relative density of the whole so accurately determined, its solid constituent parts so exactly distinguished, their mutual relation, both as to position and composition, so clearly traced or pursued to such considerable depths, as within these last thirty years. Neither have the testimonies that relate to it been ever so critically examined and carefully weighed, nor consequently so well understood, as within the latter half of the 18th century †."

† *Kirwan's Geol. Essays.*

8 Difficulties attending the study not insurmountable.

Geological researches seem at first view to be attended with almost insurmountable difficulty. It is evident that the part of the earth which it is in our power to examine, is infinitely small when compared to that which is entirely beyond our reach: and even much of the elevated parts, that appear above the surface, would seem to be so completely cut off from us by inaccessible precipices, and the ice and snow with which the summits

Introduction. mits of some of them are perpetually covered, that our knowledge of their structure and compositions must for ever remain imperfect. Much of these difficulties, however, is rather apparent than real. It is true that our researches can extend but a very little way below the surface; but so far as our experience has yet taught us, any farther investigation would be rather a matter of curiosity than utility. Those metals and minerals which prove of most service to mankind, are found at no very great depth in the earth, and some of them almost on its surface; and when we have penetrated beyond these, the materials discovered are of a nature so uniform, and of a texture so firm and hard, that it is possible they may extend even to the centre. Again, the investigations of Saussure, De Luc, Dolomieu, and Humboldt, have proved that the most dangerous precipices, and the highest summits of those immense mountainous chains which traverse the earth in so many directions, oppose but feeble barriers to persevering industry and philosophic ardour.

The diversity which occurs in the structure and local arrangement of subterraneous substances, seems to throw another difficulty in the way of the geologist; but the farther his researches are extended, the more will this apparent diversity be diminished. The practical skill which some miners possess in many parts of the world, proves that the mazes of this labyrinth are not without a clue; and we may safely conclude, that when our knowledge of the structure of the earth, and the disposition of its materials, shall be still farther extended, the greater part of the obscurities under which the subject is now veiled, will be entirely removed. Multiplied observations of later years have enabled us to form certain general conclusions, and lay down certain general laws, which must materially assist future observers.

9 Principal improvers of geology. In the modern improvements of geology the Germans led the way, and Lehmann may be considered as the father of the science. Eminently skilled in general physics, practical mining, mineralogy, and chemistry, and fully acquainted with the circumstances attending the relative situation of most mineral bodies in very extensive tracts of different countries which he examined, he was enabled to deduce, from a long series of observations, some general conclusions, which have, with some exceptions, been since verified in every part of the world.

Lehmann was followed in his own country by Ferber, Gmelin, Born, and Werner; in Sweden by Bergman, Cronstedt, and Tilas; in Italy by Arduini; in Switzerland, by Saussure and De Luc; in Russia, by Pallas; in France, by Delametherie, Saint Fond, Dolomieu, and Lavoisier; and in Britain, by Hutton and Kirwan, names which must ever be held in the highest estimation by the cultivators of this part of natural history.

10 Method of studying geology. Before entering on the study of geology, it is necessary to acquire a competent knowledge of chemistry, and a pretty extensive acquaintance with mineralogy, as these sciences form an essential introduction to the more general researches respecting the structure of the earth. The former supplies the means of ascertaining the nature of the substances met with; and the latter must be well understood, before we can arrange these substances under their proper heads, and before we can comprehend the terms employed by geological writers.

The study of this science, like that of some other parts of natural history, particularly botany, can be prosecuted with but little advantage in the closet. The student must examine the declivities of hills, the beds of rivers, the interior of caverns and of mines, the recesses of the ravine, and the utmost summits of the mountain, before he can obtain that degree of knowledge which is necessary to constitute a skilful and philosophic geologist. While making these personal observations, he should study the works of the best writers, and compare the facts related and described by them, with those which he himself has observed. The writings on this subject may be divided into two principal classes, one comprehending these works which contain a systematic account of the whole, or some part of the subject; such as Bergman's Physical Geography, the Geological Essays of Kirwan, the *Theorie de la Terre* of Delametherie, the writings of Werner, &c.: and the second comprising those works which treat of the geology of particular countries in the familiar style of travels; as Born's Travels in Hungary, Ferber's Travels through Italy, Saussure's *Voyage dans les Alpes*, Pallas's Travels, Jar's *Voyages Metallurgiques*, Saint Fond's Travels in England and Scotland, &c. After having acquired a knowledge of the principles and general facts of the science from the former, the student will, by means of the latter, increase his knowledge in the most familiar and agreeable way.

11 Arrangement. In the sketch of geology which we are to give in the following article, we shall consider the subject under four general heads, which will be the subject of as many chapters.

In the first chapter we shall describe the arrangement and distribution of the materials of which the earth is composed. Here, after giving some general notion of that arrangement, we shall consider each of the principal materials under a separate section, in which we shall first lay down those general marks by which each is distinguished, describe its general arrangement, and mention the places, especially in Britain, where the substance is found in greatest abundance, and those metallic or mineral bodies which are commonly found in connection with it.

After having briefly considered each substance, we shall, in the second chapter, bring the more general distribution of them under one view, still directing our attention to the arrangement of these materials in the British islands.

In the third chapter we shall give a brief outline of the most remarkable theories that have been framed in modern times, to account for the distribution of mineral bodies, and the manner in which we find them now arranged. In this chapter we shall dwell more particularly on the two rival theories which at present divide the geological world, and shall enumerate some of the objections which have been made to each.

In the fourth chapter we shall give some account of the derangement of the substances that compose our globe, so far as it has originated from known causes; and this will lead us to the consideration of EARTHQUAKES and VOLCANOES.

CHAP.

rangement, &c. of the Materials of the Earth.

CHAP. I. *Of the Arrangement and Distribution of the Materials of which the Earth is Composed.*

2 General distribution of the materials of the earth. THE materials of which the general mass of the earth is composed, are variously distributed in different parts. In some places they form irregular masses or blocks, either buried below the surface, or elevated to a greater or less height above it. In most places, however, the materials are arranged in a more regular manner; those of the same kind being collected into extensive masses, lying in layers or strata, above or below a similar mass of another kind, or these alternate with each other to a considerable depth. These strata are sometimes found arranged in a direction parallel to the horizon; at others they are vertical, or perpendicular to the horizon, appearing as if the horizontal strata had been lifted up, and laid upon their edges. More commonly the strata are arranged in a direction inclining to the horizon, when they are said *to dip*.

3 Stratification. The uppermost stratum is in most places covered to a certain depth with mould that has evidently been formed from the decomposition of organized substances. In many parts of the earth this mould extends to a very considerable depth, and constitutes the soil; in other places it is barely sufficient to form a coating to the strata, and in others it is entirely wanting.

4 Horizontal and vertical strata. A good instance of horizontal strata occurs about two miles to the east of Ballcycastle in the north of Ireland, of which we shall speak more particularly by and by. One of the most curious examples of vertical strata in Britain is found in the small island of Caldey, on the coast of Pembrokeshire, where the strata of which the whole island is composed are placed in such a manner, that their edges are all exposed to view, and they may be successively examined from the one end of the island to the other. It is seldom that an opportunity offers of examining the arrangement of strata so easily as is afforded in this small island. In most cases it is necessary to penetrate to great depths before we can acquire an imperfect knowledge of the stratification of the earth; and in no instance have we yet proceeded a mile below the surface. In Caldey island, however, the strata may be examined to the extent of more than a mile, beginning at what may be supposed the uppermost stratum, which is not more than a foot thick, to that which may be called the lowest, at the opposite end of the island, being a mass of red stone of more than a mile in depth.

Derangement of the strata. Sometimes the strata are continued in a regular arrangement, preserving the same inclination to a very considerable extent; but more commonly they appear in some parts separated, as if they had been broken asunder. These separations are usually in a perpendicular direction, and the cavities are found filled with various heterogeneous matters. Sometimes these are chiefly composed of fragments of the adjacent strata, but for the most part they consist of mineral or metallic substances of a different nature.

When these fissures are filled up with broken fragments or rubble, as it is called, it very commonly happens that they become the beds of brooks or rivers. Thus the river Derwent runs for a considerable extent in Derbyshire over a fissure of this kind. When the fissure is filled up with a solid stony matter, this forms what in Scotland is called a *dyke*. If a mass of mineral or metallic matters fill the fissure, or be insinuated between the strata, it forms what is called a vein, and these veins sometimes branch between the strata in various directions.

When a fracture has taken place in the stratified mass, one part of the mass sometimes preserves the same position as it had before, or still forms a continued line with the other parts of the mass, or is parallel to it; but more frequently one part is thrown out of its original position, and becomes more inclined to the horizon than before. Sometimes one side of the mass is more depressed than the other, as is commonly seen in many of the strata in Derbyshire; at others the two parts of the mass are so disturbed as to incline towards each other, as if they had been broken upwards. When the edges of the strata on each side of the fissure are thus divided and disarranged, they are said by the miners *to trap*.

The chasms thus formed are sometimes of considerable width. Some are found in Cornwall nearly 20 feet across, and almost full of metallic and other mineral substances. It not unfrequently happens, that these fissures are empty, containing nothing but water in the bottom. A celebrated chasm of this kind is shewn at the Peak in Derbyshire; and if a stone be thrown in, it is heard to strike from side to side for a considerable time, till at length it seems lost in subterraneous water.

If the country in which the strata lie runs in a waving direction of hill and dale, the strata usually preserve the same waving direction, keeping pretty nearly parallel to each other. A curious example of this kind has been described by Gerhard, as occurring in the district of Mansfield in Germany. See fig. 1. In those places where some remarkable dislocation of the strata has not taken place, their distribution is in general extremely regular, certain materials lying above or below certain others in an uniform manner. The observations of later geologists have discovered pretty nearly the arrangement that takes place in most countries; and we shall presently give some examples of the stratification of several parts of Europe. Before we attempt this, however, we must mention some circumstances in which the materials composing the strata differ from each other. Plate CCXXXVIII. 16 Strata in general regular.

17 Division of the materials. The general observation of all modern geologists proves, that all these materials may be distributed under two general classes; one consisting of those substances which are found more or less connected with the remains of organized bodies, as the bones, teeth, and shells of animals, the trunks of trees, and other parts of vegetable bodies; and the other comprehending those in the substance of which these organic remains are never found. As it is now generally believed that the latter of these are of a formation prior to the former, we shall here adopt the general division of them into primary and secondary. We might go still farther in this division, by arranging them under more heads; one, for example, containing those in which organic remains are sparingly found, and others containing those substances which are found only in particular places; but as the first of these involves in it a particular theory which we shall notice fully hereafter, and the others allude to facts which will be mentioned when treating of the separate materials, we shall not here extend our division

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division beyond the distribution of the materials into primary and secondary.

In the following short detail, many terms will occur which can be understood only by the mineralogist. They will be fully explained under the article MINERALOGY. The names which we shall give to the substances described will be such as have been most generally adopted in this country; but to prevent ambiguity, we shall, where it seems to be necessary, add the synonymous names that occur in the best geological writings.

A. Primitive Compounds.

SECT. I. *Of Granite.*

18 Granite described.

THE name *granite* has long been applied to all stones which are composed of an aggregate of quartz, feldspar, and mica, distributed in such a manner as that each of them appear in a separate state; but as this definition has been considered as too loose, and comprehending too many varieties, the name is at present restricted to that kind of granitic stone in which the quartz, feldspar, and mica, are found in grains or crystals. Of the three substances, the feldspar is generally the most abundant, and the mica the least so.

Granite is found in the lowest and the highest situations of the earth that have yet been examined. It forms the basis of all the other strata: and though these are sometimes found below it, this situation seems to have been the consequence of some accident, by which the inferior substances were thrown below the granite. Many mountains seem almost entirely composed of granite, as Gefrorn one of the Rhætian Alps; and there is a high hill of white granite about six miles to the west of Strontian in Scotland. Sometimes large masses of granite are found in a detached situation at some distance from the mountains to which they appear to belong; and these masses seem in some instances to have been broken off, and rolled down the mountain, and in others to have been carried away by irresistible torrents, or dislodged by earthquakes. On the summits of the mountains near Port Sonnachin in Scotland, are found large quantities of detached pieces of granite, some of them of amazing size *.

* *Mawe's Derbyshire*, p. 132.

19 Its different states.

Granite is most commonly found in vast blocks, separated from each other by rifts or chasms, irregularly disposed. This is the case in most mountains, especially in those which have high, pointed spires. The structure of those blocks is pretty uniform, there occurring seldom more than two varieties, one called porphyritic granite, in which the basis is of a fine grain, containing large crystals of feldspar. Of this variety many instances occur in the north of Scotland, and near Carlsbad in Bohemia. The other principal variety is that in which the granite is found in distinct globular concretions, composed of concentric lamellæ. This variety was observed by Mr Jameson, on the road between Dresden and Bautzen; and Mr Barrow, in his description of the Cape of Good Hope, mentions several globular concretions of immense size. The isle of Arran in Scotland also affords instances of the same variety. It is also found in Corsica, and is often called Corsica granite.

20 Stratified.

It has been doubted by some geologists, whether the true granite is ever found stratified; but numerous instances of its stratification have been lately adduced, that leave no room to doubt that this is sometimes the case. Pallas takes notice of some stratified granite on the banks of the river Berda, where what he considered as perfect primitive granite, compactly crystallized, is disposed in layers of various degrees of thickness, some not exceeding one-eighth of an inch, and bounded both above and below by blocks of solid granite †. Again, on the banks of the Gromoklea, he observed similar layers of granite running in a direction from north to south, each bed being from one span to three feet six inches in breadth, and consisting of the most perfect primitive granite, which he considers as a continuation of that mineral tract which produces the cataracts of the Dnieper ‡. Mr Playfair mentions an example of stratified granite which he saw in Chorley forest in Leicestershire, where real granite is disposed in beds on the eastern border of the forest, especially near Mount Sorrel. Another instance of real granite disposed in regular beds, is also mentioned by Mr Playfair as occurring near the village of Priestlaw in Berwickshire||. Mr Jameson observed the Riesengebirge, which separates Silesia from Bohemia, to be for 150 miles composed of granite disposed in horizontal strata, and he observed a similar stratification in Saxony and Lusatia §.

† *Pallas Trav.* i. p. 5..

‡ *Ibid.* ii. p.

|| *Playfair's Illustrations*, 328.

§ *Nic. Jour.* vol. ..

Granite constitutes the base of most of the British mountains, but is more commonly met with in the north and western parts of the island. There is a considerable mass of granite which runs longitudinally through Cornwall, from Dartmore to the Land's End *. Considerable masses are found in Scotland, but their extent has not been accurately ascertained. According to Mr Playfair, there is no mass of any magnitude in the southern parts, except that of Galloway, which occurs in two pretty large insulated tracts. Mr Playfair thinks that Dr Hutton greatly underrated the quantity of granite in Scotland, which, especially in the north, he considers as extending over a large district. If we suppose a line to be drawn from a few miles south of Aberdeen, to a few miles south of Fort William, it will, according to Mr Playfair, mark out the central chain of the Grampians, along which line there are many granite mountains, and large tracts in which granite is the prevailing rock †.

* *Playfair*, 310.

† *Illustrations*, 346.

It is remarkable that in the mountainous regions of Peru, especially in the environs of the volcanoes, no granite is found, except in very low situations, at the bottoms of valleys ‡.

‡ *Ann. ... Mus.* tom. 399.

Decay of granite.

Several varieties of granite are subject to decay, from the decomposition of the feldspar which they contain. This circumstance will probably explain a curious fact. It is found that the granite existing in the interior of mountains is much softer than that near the surface, probably from the decay of the feldspar in the latter, while it remains in its original state in the former (B).

Granite

(B) The decomposition of granite appears to go through several stages, from the solid rock to the loose sand. These

[Arr]ange-[men]t, &c. [of th]e Ma-[ter]ials of [the] Earth. Granite is by no means abundant in metallic and the richer mineral substances; it, however, contains a considerable variety, some of which have as yet been found in no other substance, especially molybdena. Iron ores are very commonly found in granite, especially the

23 [Met]als [foun]d in [gra]nite. compact brown iron stone. It seems to be owing to the presence of iron that granite assumes that fine reddish colour with which we sometimes see it tinged. One of the most remarkable instances of this kind is afforded by the rocks to the south-east of the valley of Chamouni, at the foot of the Alps. These rocks, from their red appearance, are called *Les Aiguilles Rouges*, or the red needles. These rocks were mentioned by Saussure, but he had not ascertained their composition. This has since been done by M. Berger, who found them to be composed of granite, with a considerable quantity of oxide of iron *. Bismuth, cobalt, blende, galena (an ore of lead), and several ores of copper, are also sometimes met with; but the metal most frequently found in granite is tin, especially in the great mining field in Cornwall.

* *[J]our. de [Ph]ys. tom.* p. 277.

Sect. II. *Gneiss.*

24 [Gne]iss de[scri]bed. Gneiss, by some writers called *kneiss*, is not unfrequently confounded with granite, from which it differs rather in the arrangement than in the nature of its component parts. These in gneiss are arranged in a schistose or slaty form, whereas in granite, they are in distinct grains or crystals, the layers being generally in the direction of the mica. It sometimes is intimately incorporated with masses of granite, but, in most instances, it reposes on the granite, being generally the second layer. In descending into the valley of Chamouni, Saussure observed a fine bed of true granite incorporated with a rock of gneiss, which was arranged in very fine leaves †. Sometimes the gneiss lies entirely below the granite; but this is uncommon. More generally there is found a vertical mass of granite, with strata of gneiss on each side of it. Very frequently granite and gneiss alternate with each other.

† *[Vo]yage [des] Alpes,* [..]6.

25 [Whe]re [foun]d. Sometimes whole mountains are composed of gneiss. Thus Ben Lomond scarcely contains any other substance, and the Schaw, which is the most northern point of the northernmost of the Shetland islands, is entirely gneiss. Mountains of this kind are, in general, neither so high nor so steep as those of granite, though Mount Rosa in Italy, and a few others, must be excepted. The summits of these mountains are also generally more rounded than those of granite mountains. The bases of all the Shetland islands seem chiefly composed of gneiss, and the middle part of the Pyrenees is almost wholly formed of this and granite.

It is curious that where gneiss is contiguous to granite, its quartz and feldspar are more apparent, and the mica less so; while, where it is more distant from granite, the contrary happens ‡. Arrangement, &c. of the Materials of the Earth.

Several metallic ores are found in gneiss, particularly those of iron, as the magnetic iron stone, and martial pyrites; lead ores, tin ores, blende, cobalt, copper, and arsenical pyrites, and not unfrequently silver ores. 26 Metals found in gneiss.

‡ *Kirwan's Essays,* p. 175.

Sect. III. *Micaceous Schistus.*

This is otherwise called *schistose mica*, and *mica slate*. It is also composed of the same materials with granite and gneiss, except that it contains little or no feldspar; the quartz and mica being arranged in layers as in gneiss. 27 Micaceous schistus.

This substance also is very abundant in most rocks and mountains. It generally composes the third layer or stratum, being immediately above or without the gneiss. It not uncommonly appears to be the only substance composing the hill or mountain, from the gneiss and granite being probably so completely covered as to be out of sight.

Micaceous schistus composes the rocks that are found immediately to the north of Dunkeld in Scotland, and it is here penetrated in every direction by veins of quartz. The southern shores of Loch Tay, the mountains of Glen Lochy, the vale of Tumel between Loch Tumel and Loch Rannoch, contain much of the same substance; and the lower part of Glen Tilt is chiefly composed of it. In the western Highlands towards Ben Lomond, micaceous schistus also abounds, and some of it is found in the north of Argyleshire. The Shetland islands are mostly composed of micaceous schistus, in thick layers above the gneiss, with a few masses of granite interspersed. 28 Where found.

It not unfrequently happens that a bed of micaceous schistus is intersected by veins of granite. Mr Jameson observed an example of this in Glen Drummond in Badenoch, of which he has given a plate. The veins are very large, and run across the strata of schistus in a direction nearly parallel to each other *.

* *Min. of the Isles,* vol. ii. p. 173.

The metallic ores found in micaceous schistus, are chiefly those of iron, copper, tin, lead, cobalt, and antimony. 29 Metals in it.

Sect. IV. *Quartz.*

Quartz is not unfrequently found distinct from feldspar and mica, and sometimes whole mountains are found composed of it. In particular, the mountain of Kultuc, at the south-east end of the lake of Baikal, among the Altaischan mountains, which is 4800 feet long, 350 high, and above 4000 broad, consists entirely of milk-white quartz; and the mountain of Flinzberg 30 Quartz.

These are thus marked by Mr Jameson. In its beginning disintegration it splits into masses, having a greater or less tendency to the quadrangular form; but these masses have still a degree of connexion amongst themselves, as is the case upon the mountain top. The next step is the enlargement of the fissures, by which the masses are loosened from their connexion, and tumble down from their elevated situations, upon the summits of the neighbouring mountains, or are hurried with impetuous velocity down the mountain side, covering the bottom of the glens with their stupendous ruins. Lastly, These detached masses, by the action of the weather, are completely disintegrated, forming a loose sand, which is left upon the tops or sides of the mountains, or is carried in great quantities to the sea shore by the torrents. *Jameson's Mineralogy of the Scottish Isles,* vol. i. p. 82.

Arrangement, &c. of the Materials of the Earth.

berg in Lusace, is almost wholly composed of it. There is also an extensive ridge of quartz, some miles long, in Bavaria, and Monnet mentions a rock of it 60 feet high. Mountains of it are also found in Thuringia, Silesia, and Saxony. It sometimes forms layers between gneiss and micaceous schistus. A considerable body of granular quartz is found lying under micaceous schistus in the island of Islay, see fig. 4. *b*. It is often found forming spires on the tops of mountains, and appearing like snow.

Quartz is found in several parts of Britain; but there is very little of it in the southern part of the island. Williams found it very common in the Highlands of Scotland, where he has seen it regularly stratified, with other regular strata immediately above and below it; and sometimes composing high mountains entirely of its own strata. These strata are sometimes moderately solid; but often are naturally broken into small irregular masses, with sharp angles, and of a uniformly fine granulated texture, resembling the finest loaf sugar.

There are large and high mountains of this stone in the shires of Ross and Inverness; and in a clear day these appear at a distance as white as snow, being quite bare of vegetation, except a little dry heath around the base of the hill *.

* *Williams' Mineral Kingdom*, vol. ii. p. 52.

The mountain of Swetlaia Gera, one of the Uralian chain, consists of round grains of quartz, white and transparent, and of the size of a pea, united without any cement.

31 No metals in quartz.

No metals are found in quartz, though it sometimes contains petroleum.

Sect. V. *Argillaceous Schistus.*

32 Argillaceous schistus described.

This stone, which is otherwise called *clay slate*, is the *thonchieffer* of Werner, and the *argillite* of Kirwan. It is of the same nature with gneiss and micaceous schistus; but in this the stratification is still more complete, and all traces of crystallized granite entirely disappear. Doubts have arisen whether this stone is primitive; but these are now cleared up, as it is frequently found alternating with gneiss and micaceous schistus, especially in Saxony, and with other primitive strata. It sometimes happens, too, that both gneiss and granite rest upon it.

There are two varieties of this stone, one hard, and the other soft; but the hard often graduates into the softer.

33 Where found.

Sometimes this stone is found forming whole mountains; but more commonly it enters into them only partially. In some, however, there are entire strata of it, as at Zillerthal, in the Tyrol. The famous mountains of Potosi consist entirely of argillaceous schistus, and Saussure found it on the summit of Mont Blanc.

In Britain it is not very common; but is sometimes found on the higher parts of mountains. Thus it forms the summit of Skiddaw in Cumberland.

34 Metals found in

Argillaceous schistus, especially the softer variety, is remarkably rich in metals. We have said that it forms the greater part of Potosi, one of the richest silver mines. The ores of copper and lead, sulphur, pyrites, blende, and calamine, are also found in it. The great body of copper ore in the Parys mountain in Anglesea, is found below this substance. It also sometimes contains antimonial and mercurial ores.

Sect. VI. *Jasper.*

35 Jasper described.

It was supposed, by the earlier mineralogists of the last century, that jasper was only pure quartz, so much penetrated by a colouring metallic oxide as entirely to deprive it of its transparency; but Saussure and Dolomieu, with their usual accuracy, discovered that it consists of flint, and not of pure quartz, having in combination a quantity of argillaceous matter, more or less mixed with oxide of iron.

Primitive jasper is always opaque. It is commonly found imbedded in other stony matters. In colour it varies from red to green, and frequently consists of alternate stripes of red and green, sometimes perfectly distinct, at others running together. There is a beautiful variety figured by Patrin, in which a dark-red ground is crossed in every direction with curved white lines, leaving here and there circular spaces of red surrounded with white, forming eyes.

36 Where found.

Striped jasper is sometimes so abundant, as to be the chief material of some mountains, in which it is mixed with broken fragments of granite and other primary compounds (c). Mountains of red and green jasper also occur. Generally, however, it appears in strata, interposed between layers of micaceous schistus, or alternating, and sometimes mixed with compact red iron stone. It is found in the south of France, reposing on granite; and in the Altaischan mountains, it sometimes lies below argillaceous schistus, but has there never been found in contact with granite. A coarse kind of jasper is sometimes found in the hills near Edinburgh; and some fine specimens are met with in the northern mountains.

Sect. VII. *Hornstone.*

37 Hornstone described.

This stone is considered by Mr Kirwan as the same with *petrosilex*, but Patrin and some others distinguish them.

(c) There is often found interspersed between the strata of rocks, or sometimes above the upper stratum, a bed of fragments that have been broken off from the principal strata. When these fragments chiefly consist of limestone and calcareous compounds, whether they be of an angular form, or consist of rounded pebbles, they are generally called by the name of *breccia*; but when the fragments are of a siliceous or quartzy nature, especially if they are agglutinated together, so as to form a solid mass, they have usually been called *pudding stone*. From the uncertain manner in which these terms were employed, much confusion arose, till Romé de l'Isle, and other later naturalists, have given the name of breccia to every stony mass that is composed of angular fragments, of whatever nature they be; and they call by the name of puddingstone every agglutinated mass that is composed of round pebbles, whether they be calcareous, quartzose, or of any other nature. These compounds will be spoken of presently in a separate section.

them. According to Patrin, hornstone is a compound primitive rock, composed of the same elements with granite, in which schorl is very abundant, communicating to the stone a dull gray, or sometimes blackish, colour, and containing a pretty large quantity of the argillaceous matter of mica. Petrosilex, according to him, is purer than hornstone, and commonly of a grayish or greenish colour, semitransparent, and very hard, so as to give fire with steel. They are often found united, and sometimes form entire mountains, containing fragments of feldspar interspersed. They are commonly found in large thick masses or blocks, though they are sometimes stratified like the schistose stones. Dolomieu is mistaken, when he asserts that petrosilex is only found in primitive mountains, is it will appear hereafter, that it is sometimes a secondary compound. At Tuhumas, in the isle of Rona, Mr Jameson found a mass of rock chiefly composed of hornstone and quartz, from 12 to 15 feet wide, and of considerable length, lying between two beds of gneiss.

SECT. VIII. *Pitchstone.*

THE Germans have given the name of *pitchstone*, or *pechstein*, to a stony matter, which is found in large masses of an irregular form, and of different colours, as yellow, brown, red, green, &c. having sometimes the appearance of rosin, and sometimes that of an enamel, or of glass imperfectly transparent. It is never crystallized.

It is found, either in large masses, or in veins. At Misnia, it is found forming entire mountains; and in other countries there are mountains containing strata of pitchstone, sometimes alternating with granite, at others with porphyry. Mr Jameson describes a large vein of it of a green colour, several feet wide, traversing a mass of red argillaceons sandstone, at Tormore in the isle of Arran. This vein is extremely curious, and contains stratulæ of different substances deposited in the same fissure *. Another curious vein of pitchstone is described by him as traversing a basaltic rock, together with a vein of hornstone, in the island of Eigg†. Mr Jameson considers this as the first example of pitchstone traversing basalt, discovered in Europe, though similar appearances have been found on the top of the peak of Teneriffe.

Pitchstone is only considered as a primitive rock, when it is nearly allied to porphyry.

SECT. IX. *Hornblende, and Hornblende Slate.*

HORNBLENDE is sometimes found existing separately from the compounds in which it usually occurs, as is the case in Siberia, where there are mountains of black hornblende. It is often found mixed with quartz, mica, feldspar, or schorl, of a greenish or black colour. More commonly, however, it occurs in immense strata, sometimes in layers of gneiss, argillaceous schistus, or primitive limestone. A stratum of it above primitive limestone has been found at Miltiz. It is sometimes seen below granite, or granite is even found imbedded in it. A rock of hornblende, reposing on granite, has been seen by Mr Jameson in the isle of Arran; and on the side of Loch Fine he found it alternating with strata of micaceous schistus ‡.

The principal metallic substances found in hornblende slate, are native sulphuret of iron and copper ore. Arrangement, &c. of the Materials of the Earth.

SECT. X. *Serpentine.*

SERPENTINE is a stone of a similar nature with respect to its ingredients with those we have been describing. It takes its name from its appearance, being generally of a greenish ground, marked with white, yellow, brown, or reddish spots, so as to bear some resemblance to the skin of a snake. Its green colour is owing to a quantity of slightly oxidated iron which it contains. It is usually opaque; but sometimes parts of it are semitransparent, and though not very hard, is capable of receiving a good polish.

41 Metals found in it.
42 Serpentine described.

Serpentine is by no means uncommon, and is often found in layers alternating with primitive limestone, or below gneiss. The hill of Zobtenbeg in Lower Silesia, consists almost entirely of serpentine, disposed in nearly vertical strata, with a little hornblende interspersed. Whole mountains of green serpentine are also found in Siberia, and near Genoa, where it is called *gabbro* or *pulverezza*. It is also found near the White sea, and the mountain of Regelberg in Germany is chiefly composed of it. Rocks of it are found near the Lizard Point, on the coast of Cornwall; and hills of it occur in some of the Shetland islands. 43 Where found.

Metals are seldom found in serpentine, except a magnetic ore of iron, which not unfrequently forms a part of the serpentine rocks, imparting to them its magnetic power. Veins of copper sometimes traverse it.

SECT. XI. *Porphyry.*

PORPHYRY generally consists of the same materials as granite, but in different proportions, and having altogether a different appearance; for instead of being crystallized as in granite, we find in the true porphyries an uniform compact mass, in which are disseminated small crystals of feldspar, and sometimes of schorl. There are, however, many varieties forming shades between granite and true porphyry, several of which are described by mineralogists. 44 Porphyry described.

Porphyry is very abundant in many situations, forming a considerable part of hills, and even mountains. It sometimes alternates with gneiss, and has been found below it. Gneiss has also been found in the midst of porphyry. It sometimes occurs in the midst of micaceous schistus, and sometimes forms an external covering to other primitive strata. Whole mountains of porphyry, arranged in immense strata, sometimes repose on a base of granite or gneiss. This stone is found in the greatest abundance in several places between the tropics, especially in South America, where it is sometimes met with at immense heights*. 45 Where found.

Porphyry is very common in most parts of Scotland, and, in particular, forms a considerable stratum at the top of the Calton hill at Edinburgh, being in some places 12 or 15 yards thick, covering a bed of breccia.

Porphyry is found in considerable quantity between Newcastle and Wooler, and blocks of it of considerable size may be every where seen scattered about in the fields. The feldspar of these porphyries being less durable than the rest of the stone, is partly destroyed in some

* Ann. de Mus. Nat. vol. iii. p. 400.

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some blocks, and appears corroded in others; from which circumstance the porphyries are so porous, as to appear as if they had been burnt. Porphyries of a similar appearance are found in the mountain of Esterele in Provence, on the road from Frejus to Antibes *.

There is a variety of porphyry mentioned by Charpentier, a great part of whose composition is indurated clay, and nodules of clay of different colours are found in its substance. Specimens of a similar nature occur in the western islands of Scotland. There is also a species of porphyry nearly allied to hornstone.

* *Saint-fond's Travels*, vol. I. p. 164.

46 Metals found in it.

The two varieties last mentioned are rich in metallic ores; in the former there being formed ores of silver, copper, iron, lead, and antimony; and, in the latter, sparry iron ore, native sulphuret of iron, galena, black blende, and ores of bismuth.

47 Schistose porphyry.

A stone of a porphyritic nature is described by Werner under the name of *schistose porphyry*, and is considered by Kirwan as the same with the horn slate of Charpentier. It is found among the primitive rocks of Altai, and on the borders of the lake of Baikal, in which latter place it is mixed with granite and hornblende. It is also found in Siberia, and in Bohemia. Saussure found it near Psaffensprung, intercepted between strata of gneiss.

48 Puddingstone and breccia.

Sect. XII. *Puddingstone and Breccia.*

49 Examples of breccia.

The distinction between these two stony matters was mentioned in note C: they are both sufficiently common, consisting of different materials. The breccia usually lies in bodies, almost at the top of the other primitive strata, with some of which it sometimes alternates. Stratified breccias, consisting of fragments of flints and jasper, cemented by hardened clay, are frequently found in Siberia, and sometimes alternate strata of breccia, porphyry, jasper, and other primary compounds, compose a considerable part of mountains. Some mountains in the north of Scotland contain masses of breccia, composed of fragments of red granite, micaceous schistus, and quartz, in a base of sandstone. Mount Scuraben contains strata of this kind, surmounted by a rock of white quartz. Similar appearances take place at Cromarty, at Murray frith, and two or three miles to the south of Aberdeen; but in many of these instances the breccia must be considered as secondary. Much of the northern coast of Scotland abounds with breccia.

50 Of puddingstone.

Puddingstone is also extremely common. A mountain of it is found in Siberia, near the rivulet of Tulat, being composed of fragments of jasper, chalcedony, aigue marine, and cornelian, cemented by a quartzose matter. Immense heaps, and even a mountain of puddingstone, are found at Meisenheim, in the Palatinate. Puddingstone is found in considerable abundance in passing from Loch Ness to Oban, in Scotland, and between Inverness and Dunolla. Large detached rocks of puddingstone were seen by Pallas in the village of Temirdski, in the Crimea. Some of these masses are seven or eight fathoms long, lying one above another †.

† *Pallas's Trav. in Crimea*, vol. ii. p. 197.

Sect. XIII. *Syenite.*

51 Syenite.

This name has been introduced by Werner, to denote a primary rock, essentially composed of grains of feldspar and hornblende, intimately blended together, in which the hornblende is generally most predominant. He first called it *greenstone*, but afterwards gave it the name of *syenite*, as he supposed it similar to a stone described by Pliny, as found at Syene in Upper Egypt, where it was dug in great quantities, and from thence carried to Rome, for the purpose of building public edifices.

Syenite sometimes contains a few grains of quartz and mica; but these seem to be accidental, and are always in very small quantity. This stone is not commonly stratified.

Syenite usually overlays most of the other primary rocks, and has often a bed of breccia interposed between it and the inferior strata. It is very commonly found reposing on porphyry.

Where found.

It is found in Saxony, in the environs of Dresden; at Meissen in Thuringia; in Hungary, and in general in almost all primitive chains of mountains, especially in the Alps. It is doubtless the same which Saussure found in the summit of Mont Blanc, and which he calls *granitelle*.

Metals in it.

Metallic veins are not unfrequently found in syenite. At Scharffenberg, veins of silver and lead are found in it; and it is said, that the veins of strontian in Argyleshire run in a similar rock.

Sect. XIV. *Primitive or Granular Limestone.*

Primitive limestone.

It was long doubted whether limestone was ever to be found unmixed with organic remains, or primitive; but the observations of late mineralogists and geologists have fully proved, that primitive limestone exists in considerable quantity. This stone is of granular structure, and of a whitish gray colour, though frequently of a dark iron gray, or reddish brown. It is sometimes scaly or lamellar; at others nearly compact, and is now and then found to have a splintery fracture. It is generally unmixed with other primary compounds; but sometimes particles of mica, quartz, hornblende, &c. occur in it.

Where found.

This stone is always found alternating with the primary strata, especially with gneiss, micaceous, and argillaceous schistus. It sometimes forms whole mountains, as in Stiria, Carinthia, and Carniola, in Switzerland and in the Pyrenees, being often found seven or eight thousand feet high. Three mountains in Switzerland, all exceeding 10,000 feet in height, are chiefly composed of it. In these situations it commonly forms immense blocks, without any regular dip or direction; but it is sometimes stratified, as at Altenberg near the lake of Neuenberg. It is sometimes interposed between syenite and hornblende slate. One of the most singular mountains of granular limestone is that of Filabres in Spain, consisting of a block of white marble three miles in circumference, and 2000 feet high, without any mixture of other earths or stones, and with scarcely any fissure.

A considerable part of Mont Perdu in the Pyrenees is composed of alternate vertical bands of granite, porphyry, limestone, hornblende, and petrosilex.

Granular limestone is found in various parts of Britain, especially in the north of Scotland. One of the most remarkable examples of it occurs in the island of Islay;

Islay; the central part of which is formed of a compact bed of it of considerable extent. See fig. 4. *d*. It also occurs in some other of the Western isles.

Primitive limestone often contains veins of metallic ore, especially those of galena, magnetic iron ore, blende, and pyrites.

Metals in it.

Sect. XV. *Primitive Trap.*

Primitive trap described.

Trap is a name that was long ago given by the Swedish mineralogists, to distinguish certain stones that are of a compact texture, and a dark colour, composing part of several mountains. The word originally signifies a staircase, and was given to mountains containing this stone, because their strata retire one behind the other like the steps of a staircase. But as many rocks of a very different kind, both in their nature and formation, have received the common name of *trap*, considerable confusion arose among mineralogists, with respect to what particular stones should receive this appellation. Most of the French mineralogists, as Saussure, Dolomieu, and Saintfond, make trap to signify a primitive rock, but they do not always mean the same rock. Other mineralogists, especially the Germans, understand by the name of trap, certain secondary rocks, and especially what are commonly called *basalts*.

Werner comprehends under the name of trap, several series of rocks, which are principally characterized by their containing hornblende, which is found almost pure in those which he considers as the most ancient, or what generally lie the lowest; and it degenerates gradually in the succeeding strata into a kind of blackish, ferruginous, hardened clay. He distinguishes three series or formations of traps; primitive traps, transition or intermediate traps, and stratiform or floetz traps. We shall here consider the first of these.

Primitive trap is almost wholly composed of hornblende, though it is sometimes mixed with feldspar, or more rarely with mica and some other substances. Under this general description Werner comprehends four stony substances; hornblende and hornblende slate, which we have already noticed in Section IX. primitive greenstone, and schistose greenstone.

Primitive greenstone is a mixture of hornblende and feldspar; under this there are several varieties, according as its texture is more or less granular, or compact. 1. Common greenstone, in which the hornblende and feldspar are intimately blended, is granular, and bears considerable resemblance to syenite, in which the hornblende is predominant. 2. A second variety has smaller grains, in which are imbedded crystals of feldspar, being of a structure between the granular and porphyritic. 3. A third variety has the grains of hornblende and feldspar extremely small, so as to be scarcely distinguishable. This stone loses its granular appearance, and becomes entirely porphyritic. 4. Lastly, when the mass becomes quite homogeneous, and of a complete green colour, it forms what was once called *green porphyry*, and constitutes the fourth variety †.

† Brochant, Mineral. tom. ii. p. 582.

Schistose greenstone is composed of compact feldspar, hornblende, and a little mica, of which the hornblende and feldspar are nearly in equal quantity, and it now and then contains a little quartz. Its structure is schistose.

We have been thus particular in describing what Werner understands by primitive trap, as whatever may be thought of his theoretical opinions, his talent for mineralogical distinctions and characters cannot be called in question.

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Mr Kirwan has given a long section on the distinguishing characters of trap, and its relation to basalt, &c. in his Geological Essays. He thinks that there might be formed a natural series of stones of a trap nature, taking in not only the composition, but also the texture, grain, and specific gravity, as something of this kind has been conceived and done by Werner.

58 Where found.

Primitive trap is often found in vast strata in the midst of gneiss, and veins of it running through gneiss, have been found in Knobsdorf in Silesia, and in Bohemia. It is also sometimes found in granite, and it is found passing through granite and micaceous schistus in the Western isles of Scotland. Saintfond found it alternating with granite, near St Malo; and Charpentier, with gneiss. It sometimes forms entire mountains, as in the territory of Deux Ponts; and in Norway it is found reposing on granite. It sometimes alternates with argillaceous schistus, as at Leidenburgh.

59 Metals found in it.

Primitive trap frequently contains metals, especially the ores of iron and copper.

Sect. XVI. *Topaz Rock.*

60 Topaz rock.

This stone is composed of quartz, schorl, topaz, and lithomarga, (a kind of hardened clay) the three former substances constituting small layers or plates alternating with each other. It sometimes contains cavities or geods, lined on the inside with crystals of quartz and topazes. The texture of this stone is between the schistose and the granular; that is, it is composed of plates or laminæ; but these laminæ are of a granular structure.

Topaz rock is very rare. It forms part of a mountain near Averbach, in the metallic mountains of Saxony; but no metallic matter has hitherto been discovered in it.

Sect. XVII. *Siliceous Schistus.*

61 Siliceous schistus described.

Siliceous schistus, or flinty slate, is the kieselschiefer of Werner; but there seems some dispute between his disciples, whether it be a primitive or a secondary rock; on which account we have placed it last in the former series. Brochant does the same; but Mr Jameson, in his sketch of the Wernerian geognosy, places it among the transition formations, or those which immediately succeed the primitive. It is thus described by Mr Jameson. Its colour is bluish gray; it is internally dull; its fracture in the great is imperfectly slaty; in the small, large splintery, passing into flat conchoidal; its fragments are indeterminately angular, and pretty sharp edged; it is strongly translucent on the edges; it is hard and brittle, difficultly frangible, and not particularly heavy *.

* *Jameson's Min. of Dumfries*, p. 48.

62 Where found.

An entire mountain formed of this stone is found in Lusatia, in which there are no petrifactions. It is also found in the Alps, interposed between gneiss and hornstone. Schlendgenberg, a mountain in Saxony, is for the most part composed of it, mixed with hornblende and feldspar. Kirwan considers it as the same substance

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stance which Saussure calls *palaiopetre*, which is commonly considered as petrosilex.

Flinty slate is described by Mr Jameson as among the mineral substances found in Dumfrieshire. He particularly notices an immense rocky mass of it at the entrance of the valley at Leadhills, by which the metallic veins are completely interrupted *.

No metals have been fonnd in it.

* *Mineralogy of Dumfries*, p. 64.

B. Secondary Compounds.

63 Secondary compounds.

THE substances which we are now to notice are distinguished from those which we have been describing, in containing more or less the remains of organized beings. As the inferior strata of these secondary compounds usually contain fewer organic remains than those above them, they are sometimes subdivided into two orders, one of which is considered to be intermediate between the primary and secondary strata. This is Werner's classification, of which we shall give an account in the next chapter.

SECT. XVIII. *Secondary Limestone.*

64 Secondary limestone described.

UNDER this title we shall comprehend what Werner calls transition limestone, floetz limestone, and limestone. Secondary limestone is a calcareous mass, sometimes granular, and sometimes compact, the former approaching to primitive limestone. Its fracture is scaly, and it is sometimes semitransparent. In colour it is very various, sometimes red, or rather blackish, with white veins, consisting of calcareous spar. It is often of a grayish cast. It sometimes forms vast blocks, without any appearance of stratification ; at other times it is evidently stratified. It abounds with remains of marine animals, and often contains nodules of agate, and other similar stones.

A variety of calcareous stone is described by mineralogists under the name of swinestone. It is either compact, slaty, or porous, and is said in general to contain no petrifactions, though some found in the mountain of Kinneculla contains many. It is considered by Kirwan as primeval limestone, impregnated with petroleum.

Limestone is sometimes found in oviform balls, commonly containing a grain of sand in them.

There is a variety of limestone that is very porons, and abounds in remains of vegetable matter, as impressions of leaves, &c.

65 Where found.

Secondary limestone is very abundant in most parts of the world, forming a considerable part of many mountains, and being often the principal stratum to a considerable depth below the surface. The mountain Iberg, in the Hartz, is composed of vast masses of it, irregularly rifted ; and mountains of a similar kind are found in Siberia and in the Vivarais. In some of those mountains vast caverns have been formed. Secondary limestone mountains always repose on some primitive stone ; thus, in Siberia their base consists of granite, porphyry or hornblende ; in Saxony, of granite, or granular limestone, and sometimes of argillaceous schistus ; in Switzerland, these mountains repose on argillaceous schistus or gneiss, or sometimes on calcareous puddingstone. In the Crimea, there is an immense extent of secondary limestone, between Roslof and Perekop, which is minutely described by Pallas. Great part of the summit of Mont Perdu, the highest of the Pyrenees, is composed of secondary limestone, arranged in nearly vertical strata, and so full of the remains of marine animals as in some places to appear as if composed of nothing else. Here it seems to repose on granular limestone.

The base of Mount Ingleborough in Yorkshire, which is near 30 miles in circuit, consists entirely of limestone, containing vast quantities of sea shells. This stone also forms the principal inferior strata through the greater part of Derbyshire, being arranged in beds of various degrees of thickness, from a few inches to about 200 fathoms in some places, not having been perforated; and abounding with shells, and other marine remains.

It is found in many quarries in Scotland distinctly stratified. Mr Jameson notices quarries of limestone at Closeburn, and Barjarg, and at Kellhead in Dumfriesshire.

66 Metals found in it.

Secondary limestone often contains metallic veins, especially in Derbyshire, where it abounds with galena, blende, sulphur pyrites, and copper pyrites. Sulphur is also sometimes found in it. Kirwan remarks, that in the rest of Europe limestone is seldom metalliferous.

67 Alabaster.

The stone commonly called *alabaster*, employed in making statues and ornaments, is properly a carbonated lime, nearly allied to marble ; though it is usually supposed to be a variety of gypsum or plaster stone. There is a gypseous alabaster that will be noticed presently.

Calcareous alabaster is not often white (though *as white as alabaster* is a common proverb), but generally tinctured with iron of a yellow, brown, or reddish cast. It is semipellucid, and usually so soft as to be scratched by the nail.

It is commonly found in blocks, in marble quarries, as in the island of Paros, and in several parts of Italy, particularly in the territory of Volterra in Tuscany, in Malta, &c. A variety is found in the form of stalactites of a conical or cylindrical form.

SECT. XIX. *Gray Wacke.*

68 Gray wacke described.

GRAY wacke is a stone composed of fragments of quartz and argillaceous schistus, cemented by an argillaceous matter similar to the schistus, varying in size, from that of a hen's egg, till they are so minute as to be no longer visible. It sometimes contains a matter similar to siliceons schistus.

There is a variety of this stone, called by Werner gray wacke slate, which is a simple slaty stone, which bears a considerable resemblance to argillaceous schistus. From this, however, it is to be distinguished, according to Mr Jameson, by the following characters.

" It has seldom a greenish or light yellowish gray colour, as is the case with primitive slate, but is usually ash and smoke gray. It does not shew the silvery continuous lustre of primitive clay slate, but is rather glimmering, which originates from intermixed scales of mica. Quartz scarcely occurs in it in layers, but usually traverses it in the form of veins. Further we do not find crystals of feldspar, schorl, talc, chlorite slate, or magnetic iron stone are to be observed in it. It contains petrifactions, particularly those varieties that border on gray wacke. It alternates with gray wacke *."

These stones are distinctly stratified, but the direction

* *Mineralogy of Dumf*...

of their strata is not parallel to that of the other rocks on which they lie. They are very commonly found covering limestone, especially at the foot of mountains.

Gray wacke is found in Erzgebirge, at Braunsdorf, Riesberg, and Averbach, in Voegtland, in Transylvania, on the banks of the Rhine, in Lahnthal, and some other places in Germany. It is also found in Britain; and Mr Jameson notices it among the minerals of Dumfries-shire, where the gray wacke slate is found near Moffat, in the vicinity of Langholm, in the higher parts of the valley of Esk, and behind Burnswark. The strata found in these places yield a very good slate, nearly free from mechanical mixture, and well adapted to the roofing of houses.

This species of stone is rich in metals; the greater part of the veins of lead and silver in the Hartz, especially those of Clausthal and Zellerfeld, are in gray wacke. In Transylvania, in Vorespath, it contains even rich mines of gold. The gray wacke strata on the banks of the Rhine are also traversed by some metallic veins, but those of Saxony contain nothing but blind coal.

Sect. XX. *Secondary Trap.*

Several varieties of trap occur among the secondary strata, and must be here enumerated. They all consist principally of greenstone, or that mixture of hornblende and feldspar, which constitutes the primitive traps, noticed in Section XV. but in the traps we are now to mention, the mixture is much more intimate, the grains considerably finer, and the mass appears homogeneous. We shall here notice only three principal varieties; the amygdaloid or toadstone, the globular trap, and the greenstone, called by the Wernerians transition greenstone.

1. The amygdaloid, called in Derbyshire toadstone, and sometimes *cat dirt*, appears to consist of hornblende slate in a state of decomposition, and appears very similar to a kind of wacke, of a very fine grain. It is of a blackish colour, and very hard, and often contains a number of bladder holes, which are sometimes entirely empty, at others are partially or wholly filled with spar.

It runs in immense solid beds, without any appearance of stratification or fissure, of unequal thickness, having been seen from 6 feet to 600 thick. It commonly alternates with the strata of secondary limestone, as in Derbyshire, and sometimes seems to penetrate the inferior stratum of limestone to a very considerable depth. It contains no metallic veins, and it is said entirely to intercept those which it passes in the limestone strata. Saintfond affirms that lead ore is sometimes found in cat dirt; but he seems to have been deceived by the vagueness of the term, as the miners of Derbyshire give the same name to a greenish variety of limestone, which is sometimes traversed by veins of lead ore.

2. Globular trap. This is a schistose greenstone, partially decomposed, and also resembles a fine-grained wacke; but it appears in the form of large balls, composed of concentric layers, with a hard nucleus. It is found at Altenzulze in Voegtland, and some other places. It sometimes contains veins of copper and iron.

3. Greenstone. This is almost entirely composed of feldspar, usually of a pale flesh-red colour, having sometimes imbedded in it grains of grayish quartz, scales of iron, blackish mica, and crystals of pale flesh-coloured feldspar. This rock may be confounded with porphyry, or with feldspar; but is generally considered as different from both. Mr Jameson found it in beds from three to twelve feet thick on the upper side of the Susanna vein in the valley of Leadhills, and in the mountain between Wamphray and Eskdalemuir.

Sect. XXI. *Sandstone, or Grit.*

These terms, like many others which we meet with in mineralogy, are very vague and indefinite, and are used to denote three or four kinds of stone; a calcareous, an argillaceous, and a siliceous sandstone. We shall here consider only two of them, the argillaceous and the siliceous. 75 Sandstone.

1. Argillaceous sandstone. This is the *sandstein* of Werner, and the argillaceous grit of the ordinary miners. It is composed of grains of quartz, and sometimes of siliceous schistus; more rarely of feldspar. These grains are of various sizes, and are cemented in an argillaceous matter, commonly containing iron: whence this stone is sometimes called *ferruginous* sandstone. From the coarseness or fineness of the grains, it receives the names of coarse and fine standstone. There is a very coarse kind found in Derbyshire; containing a considerable quantity of quartz pebbles. 76 Argillaceous sandstone.

This species of sandstone is found in immense beds, sometimes above 100 yards thick.

It is very distinctly stratified, and is commonly divided by fissures, into the shape of parallelopipeds. It sometimes alternates with layers of compact limestone, and often lies above a stone which we are immediately to mention, *shale* or *shiver*.

Sandstone is sometimes formed into globular concretions, composed of concentric lamellæ.

Sandstone is one of the most abundant products of nature, occurring in almost every country. In Britain it forms the uppermost stratum in many parts of Derbyshire; and in the isle of Arran there is an immense separate mass of it, forming what is called *the cock* †. In the same island it is found in Glenranza, reposing on secondary limestone. 77 Where found.

The globular concretions of sandstone are uncommon. Mr Jameson observed them in the isle of Skye, near the harbour of Portree ‡; and Reuss observed the same in Bohemia §.

This species of sandstone usually contains many petrifactions, but is generally not very abundant in metals; it however sometimes contains veins of cobalt.

2. Siliceous sandstone. This is a stone of a similar nature with the last, except that the cementing mass is also of a siliceous nature. It is found in the ports of Domica and Campara, in the isle of Arbe, and on the coast of Dalmatia, where it contains petrifactions. The hill of Platinburg consists of sandstone, with a chalcedony cement. Some fine specimens of siliceous sandstone are found in Salisbury Crags at Edinburgh, containing shells which have assumed the nature of chalcedony. It does not appear to contain metals. 78 Siliceous sandstone.

† Jameson's *Min. of the Isles*, vol. i. p. 76.

‡ *Mineral. of the Isles*, vol. ii. p. 87.

§ *Mineral. Geograph. von Bohmen*, vol. ii. s. 46.

Sect. XXII. *Gypsum, or Plasterstone.*

This is native sulphate of lime, and it appears in several forms. Six varieties are usually enumerated; common 79 Gypsum.

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mon gypsum, lenticular gypsum, crystallized gypsum, fibrous gypsum, stalactitic gypsum, and gypseous alabaster.

80 Common. 1. *Common gypsum* is a compact, granulated stone, commonly of a grayish colour, and mixed with impurities, containing a considerable quantity of carbonate of lime. Its texture is seldom laminated, but it appears like coarse loaf sugar. This kind is very abundant, many hills being entirely formed of it. Of these the most remarkable are the plasterhills in the neighbourhood of Paris, those in the canton of Bern in Switzerland, and others among the Alps. Hills of gypsum occur also in Spain and Poland; near the White sea; in Asia, where they are mostly in horizontal strata; in the north Archipelago, between Asia and America. Saussure found a mountain in Switzerland composed of gypsum, sand, and clay *. This kind sometimes contains petrifactions, and often abounds with the impressions of animal and vegetable matters; some very curious examples of which will be mentioned in a future section. It contains few metals, although copper is sometimes found in it, as are rock-salt and sulphur.

* *Voyage aux Alpes*, tom. ii. p. 528.

81 Lenticular. 2. *Lenticular gypsum* is a curious variety, which seems peculiar to Montmartre near Paris. In one of the banks in this mountain, specimens of it are found containing little lenticular bodies, distinct and disseminated through the stony matter, so as to form a great part of its mass. A specimen of this kind is figured by Patrin, in his natural history of minerals.

82 Crystallized. 3. The *crystallized gypsum* is also found chiefly in the environs of Paris, in crystals that are decaedral, or sometimes like a rhomboidal octaedron, with the pyramids truncated near the base.

83 Fibrous. 4. *Fibrous gypsum*, composed of short brittle threads disposed in bundles, is found in Derbyshire, and near Riom in Auvergne. A very beautiful variety, of a silky feel, and reticulated texture, is described by Patrin, as found in Poland, in the salt mines of Wielitska; in Russia, near the junction of the river Oka with the Wolga; in Spain; and in China,

A variety of gypsum with the appearance of vegetation is found in caverns near the baths at Matlock in Derbyshire. A beautiful specimen of it is figured by Patrin *.

* *Hist. Nat. de Miner.* tom. iii. p. 218.

84 Stalactitic. 5. Gypsum is sometimes found hanging from the sides and roof of caverns in the form of stalactites, a transverse section of which shews their internal structure to be radiated. This variety is commonly called *schlot* *.

† *Patrin ut supra*. p. 222.

85 Gypseous alabaster. 6. *Gypseous alabaster* is very similar to true alabaster, except that it does not, like that, effervesce with acids, and is in general not so strong. It is found in great abundance in Derbyshire in large masses, filling up cavities in argillaceous grit. It never forms a stratum, but is generally attended with gravel, red clay, and shells. Mr Mawe represents the lower portions as being very strong and compact, so as to form columns and pilasters ‡. This kind is also found in Franche Comté, and on the Marne about six leagues from Paris, at Lagny.

‡ *Mineral. of Derbysh.* p. 84.

Though from the ordinary form or situation of gypsum, and the organic remains so commonly found in it, there can be no doubt of its being in most cases a secondary rock; yet from its having been found mixed with mica in St Gothard, it is enumerated by some among the primary compounds.

Sect. XXIII. *Fluor Spar.*

86 Fluor spar described. This beautiful substance, which is native *fluat of lime*, is found either in large unformed masses or blocks, or crystallized in cubes or octaedrons. It is of different colours: but the most prevailing varieties are that in parallel zones or bands of green, blue, yellow, and white: and that in which a white ground is veined with a reddish brown. Some specimens are so shaded as to represent a geographical map; but these are very rare. It is so soft as to be easily turned in a lathe into those vases and other ornaments which are so commonly seen on chimneypieces.

87 Where found. Fluor spar is found in several countries of Europe, but especially in France and Britain. According to Patrin, there are mines of it in the primitive mountains of Gyromagny, in the Vosges, in the neighbourhood of Langeac, in Auvergne, and at Forez near Ambierle, that are inexhaustible §. It is also found in the mountain of Pilat not far from Lyons; among the rocks that skirt the valley of Chamouni in the Alps; in the Altaischan mountains of Asia; and in Greenland.

§ *Hist. Nat. de Min.* tom. ii. p. 288.

The most productive mines of this substance in Britain are in a mountain near Castleton in Derbyshire. Here there are two mines producing the beautiful compact fluor, called *Blue John*, which is found in pipe veins running in various directions. The fluor commonly rests upon limestone, and it frequently has this stone for a nucleus, round which it appears to have crystallized. Frequently, however, the centre is hollow. In several parts of the mine the fluor is found in detached masses, in caves filled with clay and loose adventitious matter, having the appearance as if it had been broken off from the limestone on which it had been formed; for every piece, in one form or other, seems as if it had adhered to something, and been broken off.

Some of the pieces of fluor are a foot thick, and have four or five different veins or zones: such large pieces are, however, very rare, and generally they are only three or four inches thick *.

* *Mawe's Mineral.* sect.

Saintfond, who has given an interesting account of the curiosities near Castleton, says, that fluor spar would be the most beautiful substance in nature, if it were but a little harder.

It is also found in Northumberland, in a vein among the granite mountains of Aberdeenshire †, and in one of the Shetland isles, in a vein of basalt ‡.

Fluor appears in some cases to be primitive. Thus it is found forming whole strata in the mountains of the forest of Thuringia, and in a vein of quartz in Upper Hungary.

† *Jameson's Min. of the Isles*, p. 15.
‡ *Ib.*

Sect. XXIV. *Chalk.*

Chalk. Chalk is too well known to require a description. It is not always white, but is frequently coloured. It is disposed in horizontal beds that are often many yards in thickness, and which always repose on layers of other calcareous stone of a harder structure. These beds are often of considerable extent, and very commonly

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ly contain flints, oviform limestone, and vast quantities of shells.

89 Where found.

Chalk, which is so abundant in some countries, is scarcely found in others. It is well known that the south and south-eastern parts of England, and the south and south-west of France contain vast cliffs and beds of it; much of it is also found in Zealand. It is, we believe, a rare production in Scotland, and in most mountainous tracts. It has been remarked by Pennant, that if a line be drawn from Dorchester in the county of Dorset, to the county of Norfolk, it would form the boundary of the great chalky stratum of England; no quantity having been found to the north or west of that line.

There is a mountain of chalk between Tor and Isium on the banks of the Donetz in Russia, in which some Greek monks have excavated apartments to the length of fifty fathoms *.

* Pallas's Travels, vol. ii. p.

No metals are found in chalk, though it is said that in France *martial pyrites* has been discovered in it.

Sect. XXV. *Clay.*

90 Clay.

Clay is found in various states with respect to hardness or solidity, from the soft ductile clay used by the potters and pipemakers to the perfect slate (clay slate, or *argillaceous schistus*) already described.

Soft clay is found in beds of various degrees of thickness, commonly not far below the surface, and alternating with harder clay, slates, sand, or limestone. It is generally very abundant, especially in those places where coal or rock-salt is found.

91 Indurated clay.

Clay of a harder consistence, commonly called indurated clay, or in the language of the miners *clunch*, is usually found below the softer clay, or there is sometimes a stratum of slate or similar argillaceous matter interposed. It often alternates with limestone, sandstone, or gypsum. Petrifactions and shells are often found in it, as are quartz, sulphur pyrites, martial ochre, common salt, vitriol and alum.

92 Lithomarga.

A harder state of clay forms that substance which is called by mineralogists *lithomarga* (stone clay). This is found in beds or strata often alienating with the former, with slate or with limestone, especially in coal mines. It also forms nests or balls in toadstone and similar rock. It sometimes bears the impressions of reeds and other vegetable bodies.

93 Slate clay.

The next degree of hardened clay, forms slate clay, (*schiefer thon* of the Germans). This substance, however, is not very hard, but is easily broken into angular tabular fragments. Its internal appearance is usually dull, but sometimes glimmering from a slight intermixture of scales of mica. Its colour is usually a yellowish gray, with spots or clouds of a pearl gray, or a cherry red, but sometimes it inclines to black. It usually lies between beds of sandstone, and almost always below the softer clays.

94 Slate.

A kind of clay, of a still harder consistence, forms slate or schistus. This is usually of a dark brown or blackish colour, and a laminated texture. It lies in beds, sometimes of immense thickness, usually below sandstone, or alternating with this and limestone. It often contains impressions of organic remains, and there are sometimes found in it veins of lead ore. It is a very common stratum in the coal countries.

Nearly allied to this is what the miners call rubble-stone, which is a common variety of slate found in similar situations with slate, but often very rich in metallic ores, especially iron, galena, bismuth, and cobalt. It also abounds with petrifactions. It is sometimes found in primitive rocks.

95 Rubble-stone.

Sect. XXVI. *Marl.*

96 Marl.

Marl is a substance chiefly composed of sand, clay, and calcareous matter, which is found in many places, and forms one of the most valuable natural manures used in agriculture. This is also found of various degrees of hardness, from a soft powder to a stony consistence, in which last state it forms what Kirwan calls *marlite.* In colour, it is usually of a reddish white, sometimes verging upon red; and it is not unfrequently found of a yellowish brown or blackish cast. Marl is usually disposed in considerable beds of various degrees of thickness, in valleys and other low lands, especially among the coal strata. Indurated marl occurs in the coal strata of Mid Lothian *, and it is also found in the island of Islay. Powdery marl is seen in Skye.

* *Jameson's Dumfries*, p. 106.

Stony marl, or *marlite*, is found in Bavaria, alternating with sand and sandstone. Hills of it occur in Carniola, Carinthia, and the Venetian territory. It is also found between strata of limestone and argillaceous schistus.

Sect. XXVII. *Argillaceous Ironstone.*

97 Argillaceous ironstone.

This is sometimes called metal stone, and is very common in the coal countries. It is very heavy and compact, and of various colours, from a dark brown to a blood red; the latter forms the *hæmatites* or bloodstone, one of the richest iron ores. It often contains in it spherical balls like iron bullets. It is disposed in strata alternating with indurated clay, slate clay, marl, or sandstone, seldom far below the surface. It seldom forms very extensive beds, but is often confined to particular spots.

Ironstone is found in great abundance in Cumberland, and in most parts of Scotland. It may be seen in the cliffs all along the coast of Fife, from Dysart to St Andrews.

Sect. XXVIII. *Wacke and Basalt.*

98 Whinstone.

We have already spoken of several stones under the name of *traps*, that are found both among primitive and secondary compounds. The two substances which we are now to notice are nearly allied to the traps, and have been classed with them under the general name of *whinstone.* This is a favourite term among the mineralogists of Scotland, of whom Sir James Hall employs it as a generic name to denote trap, basalt, wacke, grunstein, and porphyry †. The term is convenient, but Professor Jameson and others of the Wernerian school object to it as too vague and indefinite.

† *Edin. Phil. Trans.* vol. v. p. 46.

99 Wacke.

Wacke, or wacken, differs from trap only in being more compact and of a finer grain. It is heavy and very hard, so as often to strike fire with steel; it is dull and opaque, and breaks with an even fracture. Its colour is usually a reddish brown or gray of various shades,

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shades, and sometimes it has a greenish cast. It has usually an earthy smell, when breathed on. It is sometimes highly impregnated with iron, and often contains crystals of *hornblende*, and very commonly those of hexagonal black mica.

It often forms a considerable part of mountains, either in vast blocks, as in the hill on which Edinburgh castle stands, or in strata lying above limestone or sandstone, or alternating with these. A great part of the Calton-hill, of Salisbury craigs, and Arthur's seat at Edinburgh, is composed of strata of this kind; and similar appearances take place in the bed of the water of Leith near the town, and in the cliffs on the coast of Fife, especially at St Andrews. To the eye of the volcanic Saintfond, all these beds appeared to be lava. We are disposed to think, with Mr Playfair, that the curious instance of alternate strata of basalt (as Saintfond calls it) and limestone, near Villeneuve de Berg, described and figured by that author, affords an example of whinstone alternating with limestone, such as are seen in Scotland †. Several varieties of wacke are found in the hills near Edinburgh, and are described by Dr Townson ‡. Mr Jameson observed wacke alternating with porphyry in Skye.

† *Recherches sur les Volc.* p. 382.

‡ *Towns. Tracts*, p. 204.

100 Basalt.

Basalt has a finer grain, and is more compact, than even wacke, and is the most dense of all the whins or traps. It is found either in large blocks, covering the other strata, sometimes in the form of tables, or in regular prismatic columns, either straight or bended. We have already treated so fully of the nature, properties, and chief habitats of basalt (see BASALTES), that little remains to be added here.

It is principally distinguished from wacke, where it is not in regular prisms, by very rarely containing crystals of mica, which are so common in the latter.

Saintfond, in his splendid work *Sur les Volcans eteints du Vivarais*, &c. has figured some examples of basaltic pillars which rival those of Staffa and the Giants Causeway. A more romantic situation is scarcely to be conceived than that drawn in his eleventh plate, of a village placed in the front of a bold hill covered with bundles of small pillars lying in every direction, and having detached perpendicular columns standing at each end, with a large cave directly behind the houses. Large masses of basalt are seen in the north of Shetland, standing insulated, and assuming a very grotesque appearance. Mr Jameson describes one of these in the isle of Jura, that forms a natural arch. We remember seeing two curious insulated rocks on the shore at the foot of Kinkeld braes at St Andrews, but do not recollect whether they are of a basaltic nature.

Several other substances, as sand, gravel, peat, &c. might here be noticed, but their structure and situation are too well known to render a particular notice necessary.

Many of the stones which we have described among the primitive rocks, are also sometimes found among the secondary strata, as argillaceous schistus, hornstone, hornblende, jasper, and especially puddingstone; but they are not so important as to require a second examination.

Before we conclude this general account of the materials which compose our globe, we must briefly notice two of the most valuable mineral productions, viz. rock salt and coal, and must say something of fossils and petrifactions.

SECT. XXIX. *Rock Salt.*

101 Rock salt described.

ROCK salt or sal gem, (the *steinsal* of the Germans) is the purest muriate of soda that is found in nature, it being much less impregnated with foreign matters than what is procured from sea water. It is very hard, and generally very transparent, being sometimes as clear as crystal. It is usually white, but often yellowish, blue, red, or violet, and now and then it is quite opaque. This salt forms in the bowels of the earth horizontal beds or banks, more or less thick, from a few inches to many hundred fathoms; and sometimes extending several miles round. It commonly alternates with clay or gypsum. The beds are sometimes without any break for a great extent. It is generally found a few fathoms below the surface, and in some places is found continued to the depth of 1000 feet.

102 Where found.

It is found in some mountains; and in Algiers, near the lake called *Marks*, there is a mountain almost wholly composed of it. The famous salt mine of Wielitska in Austrian Poland, about eight miles to the south-east of Cracow, is in the northern extremity of a branch of the Carpathian mountains. The salt found here is of an iron gray colour, intermingled with white cubes; and sometimes large blocks of salt are found imbedded in marl. This famous mine has been worked ever since 1251, and it is pretended that its excavations extend more than a league from east to west *. About five leagues to the south-east of Cracow are the salt mines of Boschnia, the depth of which is nearly equal to those of Wielitska (1000 feet); but the salt procured from them is less pure †. Mines of salt, in horizontal undulated beds, occur at Thorda in Transylvania, and in Upper Hungary. In the side of a mountain, about two leagues from Halle, on the banks of the Inn, to the north-east of Inspruck, rock salt is found imbedded in layers of a slaty rock; but there is one part of the mountain in which there occurs an immense body of salt, without any mixture of rock, to which they pass by a gallery 260 toises in length, closed at the end with a locked door. This salt is very impure ‡. There are three important salt mines in Spain; the first near Mingranella, in a mountainous tract, between Valentia and Castile, imbedded in layers of gypsum; the second in Spanish Navarre, in a ridge of hills composed of limestone and gypsum; and the third that of Cardona in Catalonia, about 16 leagues to the north-east of Barcelona, which is one of the most curious natural productions with which we are acquainted. It consists of an immense solid rock of salt, elevated 500 feet above the earth, and extending to a depth that has not been ascertained. It is without crevices or clefts, and has no appearance of strata, and is near a league in circuit. There is no plaster or gypsum found in the neighbourhood, and the salt rock is as high as any of the adjacent hills ||.

* *Townson's Travels in Hungary*, p. 338.

† *Jour. des Mi*[...], N° 47.

‡ *Jar's Voy.* tom. ii p. 325.

|| *Bowles's Nat. Hist. of Spain.*

10[3] Salt mines at Northwich.

Rock salt is found in several places in England, particularly at Northwich in Cheshire, at Droitwich in Worcestershire, and near Weston in Staffordshire; but the mines in Northwich are the most productive. Salt mines, in this situation, were known to the Romans; but

but the principal mine that is at present wrought, was discovered in the beginning of last century. It forms immense quarries, extending over several acres, which, with their huge crystal pillars and glittering roof, present a most beautiful spectacle. The salt found here is of a dark-brown colour, like brown sugarcandy, and is so hard that it is blasted with gunpowder to get it from the mass. It is disposed in beds, alternating with beds of clay, gypsum, and slaty stone. Salt is procured at the greatest depth hitherto explored; and wherever a shaft is sunk in the neighbourhood, there is a certainty of finding salt *.

Besides these extensive mines, rock salt is found in the canton of Berne in Switzerland, in Siberia, in Arabia, in Tibet, and even in New Holland. It is also found in many parts of America, at a great height in the mountains, especially those of Peru.

* Mawe's Mineral. of Derbysh. xv.

Sect. XXX. *Coal.*

104 Coal.

We have already, in the articles Coal and Coalery, treated of the nature of this substance, of the strata that are usually found connected with it (according to the phraseology of the miners), and of the method of procuring it from the pits; and, in Mineralogy, we shall give a particular account of the several varieties, and the distinguishing characters of each. A few observations respecting the principal collieries, with the appearance of the coal found in them, and the corresponding stratification, fall to be made in this place.

There are certain general circumstances that attend the depositions of coal in almost every place where it is found, and which we must mention before noticing the particular collieries. These are as follows.

105 General circumstances attending coal strata.

1. The beds in which coal is disposed, usually have their extremities near the surface of the ground, from which they bend obliquely downwards, the middle part of the bed being nearly horizontal, so that a vertical section of the bed nearly resembles the keel of a boat. This figure is well expressed in the first and third plates to Mr Jameson's Mineralogy of Dumfries. The lowest part of the bed is usually the thickest (D).

2. A bed of coal is seldom found single; but, in general, several strata occur in the same place, of various thickness, the upper being usually very thin, and the lower very thick, with several stony strata between each two. Where there is only one bed, this is generally of very considerable thickness. At Whitehaven there are found at least 20 coal strata below the surface; and at Liege, in France, there are no less than 60.

3. The strata that separate the layers of coal are nearly the same in every colliery, and will be seen by referring to the table given under Coalery, and by those which will immediately be added. Those strata which are in immediate contact with the coal, are either whinstone, or more commonly an argillaceous slaty mass; and near this is sandstone, in layers that are separated by slaty clay, mixed with particles of coal.

4. It is an observation which holds, almost without exception, that the slaty strata, and especially those next the coal, bear the impression of vegetables, and often of exotic or unknown plants.

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106 Where found.

Coal, in a greater or less quantity, but of very different qualities, has been found in most countries, and perhaps exists in all. It is found in France, Holland, Britain, Germany, Saxony, Portugal, Switzerland, and Sweden; in China, Japan, and in New Holland; and much of it is worked in Virginia in America. But France and Britain may be considered as the favourite seats of this invaluable commodity, which may justly be put in competition with the treasures of Potosi and Peru.

107 Coal mines of France.

It is stated by Buffon, that there are no fewer than 400 collieries worked in France; and yet Saintfond regrets that his countrymen are not so far advanced in the use of this mineral as the inhabitants of Britain *. The most considerable coal mines in France, are those in the Lyonnois, at Forez, Burgundy, Auvergne, Languedoc, Franche Comté, and Liege.

* Saintfond's *Travels*, tom. i. p. 114.

The mines in the Lyonnois, and those of Forez, are among the most important in France. They are situated in a valley, extending from the Rhone to the Loire, in a direction from north-east to south-west, between two chains of primitive mountains, and they occupy in length a space of six or seven leagues, from Rive-de-Gier to Firmini. In one part of the valley, in the neighbourhood of Saint-Etienne, the strata are nearly horizontal, and the medial thickness of the coal stratum is from three to six feet; and near the Loire there are from 15 to 20 of these. At Rive-de-Gier the strata are almost vertical, and their thickness is very unequal, being seldom less than three feet, and sometimes amounting to 40 or even 60. All the coal produced by these mines is of an excellent quality, and its quantity is immense. Patrin states, on the most undoubted authority, that there are in the neighbourhood of Rive-de-Gier, no less than 40 mines at work, which produced in one year 1,600,000 quintals of coal †.

† *Histoire Nat. de Miner.* tom. v. p. 223.

The next in importance are the coal mines of Liege. The beds of coal in that country have a direction from east to west; they commence about a league to the east of the town, and extend to about a league and a half to the west of it. Here, after meeting with some interruption, they extend for several leagues farther. Their breadth, from north to south, is about three-fourths of a league. At Verbios, which is to the north-west of the city, there are, according to Jars, more than 40 strata of coal, which are separated from each other by beds of different kinds of sandstone, of from 30 to 100 feet in thickness ‡. Gennetè has counted 61 of these beds, placed one above another; and he is of opinion, that the lowest penetrates to the depth of 4000 feet perpendicular. Though these mines have been wrought from the 12th century, they have not yet reached to more than the twenty-first bed, at the depth of a little more than 1000 English feet §.

‡ *Jars' Voy. Metal.* Mem. xiv. p. 283.

§ *Patrin*, tom. v. p. 330.

The

(D) Saintfond, in the section which he has of the coal strata at Newcastle, describes them as if they were convex towards the upper surface. (See p. 134. of vol. i. of the English Translation of his Travels in England, &c.). Surely this is a mistake.

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108 Principal collieries of England.

The principal collieries of Britain are those of Newcastle and Whitehaven.

Newcastle is surrounded by collieries to the distance of six or seven leagues, and may, perhaps, be considered as the richest coal district in the world. There are in several of the Newcastle mines not fewer than 16 beds of coal, two of which are considerably thicker than the rest, being each about a fathom in thickness. These are called the *main coal*, and are distinguished into the *high main coal*, and the *low main coal*, separated from each other by a considerable number of stony strata. Good coal, in sufficient quantity, is generally found at the depth of little more than 100 feet. The bed is five feet thick in some places, and less in others; but, in general, it is easily wrought, and large pieces are brought up. This last circumstance is of considerable advantage, as these pieces are most proper for chamber fires, and easily transported, which makes this kind of coal sell at a higher price. Where the bed of black and bituminous clay is penetrated, the coal is found adhering to it: but this is not always the case, for there are other mines in the neighbourhood where freestone is recovering, which, in the points of contact, is mixed with coal to the thickness of two or three inches; the latter running, as it were, in splinters into the stone, and having a ligneous appearance, when attentively examined *.

* *Saint-fond's Travels*, vol. i. p. 140.

At Whitehaven, the beds of coal lie in a direction parallel to each other. Their inclination or dip is nearly to the west, and is from one yard in eight, to one in twelve. The strata are frequently interrupted by large fissures, or dykes, some of which remove the strata upwards or downwards, 120 feet. The course of these fissures is almost east and west. In a depth from the surface of 165 and a half fathoms, there are, in these collieries, seven large beds of coal, and 18 thin beds, which cannot, at present, be rendered profitable.

The strata superincumbent on the large beds of coal are, 1st bed, Blue slate. 2d, Gray freestone. 3d, Hard, white freestone. 4th Blue slate, striated or speckled with freestone. 5th, Gray slate. 6th, Hard, white freestone.

The strata immediately beneath these large beds of coal, are from one and a half to six inches thick, and consist of a species of argillaceous earth, or *shale*. As this earth is of a very soft or friable nature, the weight of the superincumbent strata presses the pillar of coal through it. If the pillar descends a few inches, the roof not equally yielding at the same time, crushes, or breaks into small pieces. When, under these circumstances, the thickness of the bed does not exceed six feet, nor the depth 30 fathoms, the surface of the earth is sensibly affected *.

* Dixon's *Life of Dr Brownrigg*, p. 10[illegible]

There appear to be two principal belts of coal in this island, extending from the eastern to the western coast; one from Newcastle to Whitehaven, the other from the east coast of Scotland, across the vale of Forth and Clyde, to Ayrshire. Coal is indeed found in many other parts of the island; but the quantity is very trifling.

The similarity of situation, and the similar nature of the coal at Whitehaven and Newcastle, would naturally lead us to infer, that the coal at both places is from the same seam. But this is placed beyond dispute, by a comparative examination of the strata in both situations. We shall here give two tabular views of the strata, one taken from Saintfond's Travels, and the other from Dr Joshua Dixon's account of the Whitehaven mines, in his literary life of Dr Brownrigg. Allowing for the different names given by different miners to the same substances, and Dr Dixon's greater minuteness, there is a wonderful similarity between the two tables.

TABLE I. Strata in Restoration Pit, St Anthon's Colliery, Newcastle, to the depth of 135 fathoms.—From *Saintfond*.

N°	Stratum.	Fath.	Feet.	Inch.
1	Soil and clay,	5	–	–
2	Brown freestone,	12	–	–
3	Coal, I.	–	–	6
4	Blue metalstone,	2	5	–
5	White girdles,	2	1	–
6	Coal, II.	–	–	8
7	White and gray freestone,	6	–	–
8	Soft blue metal stone,	5	–	–
9	Coal, III.	–	–	6
10	Freestone girdles,	3	–	–
11	Whin,	1	4	6
12	Strong freestone,	3	1	–
13	Coal, IV.	–	1	–
14	Soft blue thill,	1	5	–
15	Soft girdles mixed with whin,	3	5	–
16	Coal, V.	–	–	6
17	Blue and black stone,	3	4	–
18	Coal, VI.	–	–	8
19	Strong freestone,	1	3	–
20	Gray metalstone,	1	4	–

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N°	Stratum.	Fath.	Feet.	Inch.
21	Coal, VII.	–	–	8
22	Gray post mixed with whin,	4	1	–
23	Gray girdles,	3	1	–
24	Blue and black stone,	2	2	–
25	Coal, VIII.	–	1	–
26	Gray metalstone,	2	–	–
27	Strong freestone,	6	–	–
28	Black metalstone, with hard girdles,	3	–	–
29	High main coal, IX.	1	–	–
30	Gray metal,	4	3	–
31	Post girdles,	–	2	–
32	Blue metal,	–	4	–
33	Girdles,	–	1	2
34	Blue metalstone,	5	–	–
35	Post,	–	1	–
36	Blue metalstone,	3	–	–
37	Whin and blue metal,	–	1	6
38	Strong freestone,	3	3	–
39	Brown post with water,	–	–	7
40	Blue metalstone, with gray girdles,	2	2	–
41	Coal, X.	–	3	–
42	Blue metalstone,	3	–	3
43	Freestone,	–	4	–
44	Coal, XI.	–	–	6
45	Strong gray metal, with post girdles,	2	–	6
46	Strong freestone,	1	1	–
47	Whin,	–	1	–
48	Blue metalstone,	1	2	7
49	Gray metalstone, with post girdles,	2	4	5
50	Blue metalstone, with whin girdles,	1	4	3
51	Coal, XII.	–	1	6
52	Blue gray metal,	–	3	8
53	Freestone,	2	–	7
54	Freestone mixed with whin,	2	–	–
55	Freestone,	1	2	–
56	Dark blue metal,	–	2	2
57	Gray metalstone and girdles,	2	2	–
58	Freestone mixed with whin,	3	–	7
59	Whin,	–	1	–
60	Freestone mixed with whin,	1	–	6
61	Coal, XIII.	–	3	3
62	Dark gray metalstone,	–	3	6
63	Gray metal and whin girdles,	1	4	10
64	Gray metal and girdles,	1	3	–
65	Freestone,	–	3	–
66	Coal, XIV.	–	3	2
67	Blue and gray metal,	–	4	2
68	Coal, XV.	–	–	9
69	Blue and gray metal,	2	–	–
70	Freestone mixed with whin,	–	4	6
71	Gray metal,	–	–	6
72	Gray metal and girdles,	1	–	9
73	Low main coal, XVI.	1	–	6

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TABLE II. Strata in Croft Pit at Preston-Hows near Whitehaven, to the depth of 107 Fathoms. From *Dixon*.

N°	Stratum.	Fath.	Feet.	Inch.
1	Soil and clay,	1	1	–
2	Brown soft limestone,	1	3	–
3	Dark-coloured limestone, harder,	1	–	–
4	Yellowish limestone mixed with spar,	–	4	–
5	Reddish hard limestone,	–	3	6
6	Hard dark-coloured limestone,	–	1	4
7	Yellowish limestone mixed with spar,	–	4	–
8	Soft brown limestone,	–	4	2
9	Soft brown and yellow limestone mixed with freestone,	–	2	6
10	Limestone mixed with yellow freestone,	–	2	–
11	Reddish soft freestone,	–	1	6
12	Red slate, striated with freestone in layers,	–	2	6
13	Red freestone,	7	–	6
14	Soft red stone,	–	–	6
15	Red slate striated with red freestone,	4	1	–
16	Red slate striated with freestone,	4	3	–
17	Strong red freestone, rather grayish,	4	5	9
18	Lumpy red freestone speckled with white freestone,	–	–	9
19	Blue argillaceous schistus speckled with coal,	–	–	9
20	Red soapy slate,	2	1	–
21	Black slate with a small appearance of coal,	–	1	–
22	Ash-coloured friable schistus,	–	4	6
23	Purple-coloured slate,	3	5	3
24	The same, and under it black slate,	–	4	–
25	Coal, I.	–	1	–
26	Soft whitish freestone,	1	4	2
27	Blackish slate, a little inclined to brown,	–	4	11
28	Coal, II.	–	1	10
29	Blackish shale intermixed with coal,	–	2	6
30	Whitish freestone,	1	2	6
31	Strong bluish slate mixed with freestone,	–	3	–
32	White ironstone,	–	1	–
33	Freestone striated with blue slate,	–	1	8
34	White freestone in thin layers,	1	3	3
35	Dark-blue slate,	2	1	6
36	Coal, III.	–	–	9
37	Dark gray shale,	–	5	8
38	Coal, IV.	–	2	–
39	Gray freestone mixed with ironstone,	1	2	–
40	Hard white freestone,	2	3	6
41	Coal, V.	–	1	–
42	Shale mixed with freestone,	1	2	–
43	Olive-coloured slate adhering to black slate superincumbent on coal,	–	2	4
44	Coal, VI.	–	1	1
45	Black shale mixed with freestone,	1	2	8
46	White freestone mixed with slate,	1	2	–
47	Dark blue slate,	3	4	4
48	Coal, VII.	–	1	3
49	Black shale mixed with freestone,	1	1	6
50	Strong white freestone,	1	–	–
51	Brown ironstone,	–	3	–
52	Dark-gray slate,	1	–	–
53	Dark-gray shale with an intermixture of Coal, VIII.	–	5	6
54	Light-coloured slate mixed with freestone,	–	5	6
55	Blue slate striated with freestone,	1	4	–
56	Strong white freestone a little tinged with iron,	–	2	6

N°	Stratum.	Inch.	Fath.	Feet.
57	Very black shivery slate,	1	4	3
58	Strong coal of a good quality, IX.	–	–	4
59	Soft gray slate,	–	–	3
60	Very black coal, X. burns well,	–	–	8
61	Hard black slate,	–	1	7
62	Coal mixed with pyrites, XI.	–	1	2
63	Argillaceous schistus, gray and brittle,	–	3	–
64	Blue rough argillaceous schistus,	–	4	6
65	Fine blue slate,	–	3	–
66	Freestone mixed with ironstone,	–	3	–
67	Black shivery slate,	1	–	–
68	Dark-blue slate, very fine,	–	5	6
69	Dark-blue slate, very brittle,	–	–	6
70	Coal, XII.	–	2	6
71	Soft gray argillaceous schistus,	–	–	6
72	Argillaceous schistus mixed with freestone,	–	2	–
73	White freestone with fine particles,	1	1	–
74	Blue slate striated with white freestone,	–	4	7
75	Light-blue slate,	–	3	–
76	Blue slate a little mixed with ironstone,	2	–	–
77	Black shivery slate,	–	1	–
78	Coal, XIII.	–	–	6
79	Brownish hard slate,	1	3	–
80	Strong blue slate tinged with ironstone,	4	4	6
81	Dark-blue slate rather inclined to brown,	–	1	6
82	Black shivery slate,	–	–	6
83	Coal, XIV.	–	1	–
84	Lightish-gray, brittle soapy schistus,	–	4	–
85	Freestone striated with blue slate,	1	1	–
86	Fine blue argillaceous schistus striated with freestone,	–	4	–
87	Black slate, with hard, sharp, and fine particles,	–	3	–
88	Very light blue slate, remarkably fine,	4	3	–
89	Coal, XV.	–	5	4
90	Soft gray argillaceous schistus,	–	4	3
91	Black shivery slate,	–	2	2
92	Coal, XVI.	–	1	3
93	Strong lightish-coloured shale,	–	3	4
94	Blue slate striated with white freestone,	–	3	4
95	Ironstone,	–	–	4
96	Gray slate,	–	3	9
97	Strong white freestone,	–	5	6
98	Freestone striated with blue slate,	–	–	10
99	White freestone,	–	1	3
100	Freestone striated with blue slate,	–	3	11
101	Black slate,	–	–	5
102	Freestone striated with blue slate,	–	1	4½
103	Strong white freestone,	–	–	4
104	Freestone mixed with blue slate,	–	2	4
105	Strong white freestone,	–	–	5
106	Grayish slate of a shivery nature,	1	–	–
107	Freestone mixed with blue slate,	–	4	–
108	Very strong white freestone,	–	5	3
109	Fine blue slate,	–	2	3
110	White freestone striated with blue slate,	–	–	7½
111	Fine blue slate,	–	–	4
112	White freestone,	–	2	1
113	Freestone striated with blue slate,	–	–	10
114	White freestone,	–	–	4
115	White freestone in thin layers,	–	–	5
116	Fine blue slate,	–	2	1
117	Coal, XVII.	1	1	10

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An interesting and valuable memoir on the subject of coal, written by M. Duhamel the younger, was presented a few years since to the Academy of Sciences at Paris, who adjudged it the prize that had been offered for the best essay on the subject. An ample abstract of this memoir appeared in the *Journal des Mines*, N° vii. In this paper is given a table of the number of veins, their direction and inclination, and the nature of the strata next the coal, and in the neighbourhood, in all the principal mines in Europe. For a fuller view of the natural history of coal, the readers may consult Dr Millar's edition of Williams's Mineral Kingdom, 1810.

Sect. XXXI. *Of Fossils and Petrifactions.*

109 Fossils.

Those organic remains of vegetable and animal matter which are found below the surface of the earth, mixed with the stony matters which are properly the component parts of the earth, are generally called *fossils*, or *extraneous fossils.* If they have entirely lost all traces of vegetable or animal matter, and have assumed a stony earthy nature, they are called *petrifactions.*

Some of these organic remains, particularly those of the vegetable kind, are found penetrated with a bituminous substance, so as to be rendered highly inflammable. One of the most curious circumstances attending these fossil bodies is, that they are very commonly natives of a different country from that in which they are found, or are the remains of species that are now no longer known.

We may properly divide these substances into those of the vegetable and those of the animal kingdom.

1. *Vegetable fossils.* Almost every part of vegetables, the trunks, branches, leaves, and fruits, have been found in a fossil state, or impressions of some of them are seen in various mineral substances, especially in the slaty stone which accompanies coal.

Fig. 6. represents a curious example of this, that was found in the mines at Saint Etienne in France.

A, is a fruit resembling that of coffee. B, is a portion of an unknown vegetable, apparently of the verticillate tribe. C, is a species of fern, which is very remarkable, as it is furnished with fructifications. D, is part of a plant with verticillate leaves, probably a species of *galium.* E, is some exotic fruit.

Whole trees are often found below the surface of the earth, especially in bogs and mosses, sometimes retaining much of their vegetable nature, but more commonly either impregnated with bitumen or completely petrified. Subterraneous trees are frequently dug up in the isle of Anglesea; and in the isle of Man there is a marsh six miles long and three broad, in which fir trees are found in great quantities; and though they are 18 or 20 feet below the surface, they appear as if standing firmly upon their roots. Subterraneous trees, in various states, are frequently found in Ireland, especially in the neigbourhood of Lough Neagh. Much has been written on the subject of these petrifactions of Lough Neagh, by Dr Boate, in his Natural History of Ireland; by Mr Molyneux, in the Philosophical Transactions, N° clviii. and Dr Barton in his Lectures on Natural Philosophy. Some of these trees are represented as of an immense size *. One of the most curious instances of vegetable fossils, is that related by Rammazzini, as seen by him at Modena in Italy. At the bottom of wells, that are dug there below stony masses, which appear to have been the foundation of a former city, at the depth of near 30 feet, they find heaps of wheat entire, filbert trees, with their nuts, briars, &c. They find, likewise, every six feet, a layer of earth, alternating with branches and leaves of trees.

At the depth of 28 feet, or thereabouts, they find a chalk that cuts very easily. It is mixed with shells of several sorts, and makes a bed of about 11 feet. After this they find a bed of marshy earth, of about two feet, mixed with rushes, leaves, and branches. After this bed comes another chalk bed, of nearly the same thickness with the former, which ends at the depth of 49 feet.

That is followed by another bed of marshy earth like the former; after which comes a new chalk bed; and these successive beds are always found in the same order. The auger sometimes finds great trees, which give the workmen much trouble. They see also sometimes at the bottom of these wells, great bones, coals, flints, and pieces of iron †.

These vegetable fossils are generally of a flinty structure, being sometimes rough and sandy; at others so hard and compact as to admit of a fine polish. Some beautiful specimens of petrified wood, of the appearance of agate, are to be seen in cabinets of natural history. That of Besson at Paris contains two examples of this kind, which are figured at fig. 7. and 8. Fig. 7. is a transverse section of a piece of agatized wood, in which the ligneous texture is most completely preserved. Fig. 8. is another more compact, and which has the additional singularity of containing several worms. The white oval spots are supposed to have been eggs, from which the worms had issued. In Dr Millar's Mineralogical Cabinet there is a similar specimen containing worms and their ova from Siberia, as well as many beautiful specimens of agatized wood from Siberia and Germany.

110 Bovey coal.

Among the bituminous vegetable fossils, none have attracted more attention than what is called *bovey coal*, a substance of an intermediate nature between wood and pitcoal, which is dug up in a common near Chudleigh in Devonshire. It is of a laminated texture, of a chocolate, or sometimes of a shining black colour, like deal boards that had been half charred. It burns heavily, and consumes to light gray ashes. It is regularly stratified among beds of sand and clay, and the beds of coal are sometimes of considerable thickness. Mr Parkinson has collected much information respecting the former and present state of this coal, in his entertaining work on fossils ‡.

111 Animal fossils.

2. *Animal fossils.* Fossils of animal matters are still more common than those of vegetables. Shells and bones are found in almost every bed of limestone, and in almost every country, at the bottom of the deepest valleys, and at the tops of very considerable mountains.

In the limestone strata in Derbyshire are found many of those fossils, which are called *star-stones*, and *screw-stones*, which appear to be the remains of marine animals called *encrini.* These are described by Whitehurst, who has given figures of similar animals brought entire from the West Indies §. Fig. 9. represents one of these stones.

The isle of Cherea in Dalmatia contains caverns in which are found prodigious quantities of fossil bones of oxen,

* Parkinson's Organic Remains, letter vii.

† Ray's Discour. p. 223.

‡ Organic Remains, vol. i. letter xii.

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oxen, horses, and sheep. Similar examples occur in many places; but human bones are, we believe, never found in a fossil state.

Fossil shells are found on the Alps, on the top of Mount Cenis, on the Apennines, on the mountains of Genoa, and in most of the quarries of stone and marble in Italy; in most parts of Germany and Hungary, and indeed generally in all the elevated places in Europe. We also find them in the stones whereof the most ancient edifices of the Romans were constructed.

In Switzerland, Asia, and Africa, travellers have observed petrified fish in many places; for instance, on the mountains of Castravan, there is a bed of white laminated stone, and each lamina contains a great number and diversity of fishes; they are, for the most part, very flat, and extremely compressed, in the manner of fossil fern; yet they are so well preserved, that the minutest marks of their fins and scales are distinguishable, and every other part, whereby one species of fish is known from another.

There are likewise many *echenites* and petrified fish between Iver and Cairo, and on all the hills and heights of Barbary, most of which exactly correspond with the like species taken in the Red sea.

The long chain of mountains which extend from east to west, from the lower part of Portugal to the most eastern parts of China, those which stretch collaterally to the north and south of them, together with the mountains of Africa and America, which are now known to us, all contain *strata* of earth and stone, full of shells.

The islands of Europe, Asia, and America, wherein Europeans have had occasion to dig, whether in mountains or plains, all furnish us with shells, and convince us that they have this particular in common with their adjacent continents.

The *glossopetra*, or the teeth of sharks and other fishes, are found in the jaws, polished and worn smooth at the extremities, consequently must have been made use of during the animal's life; and in shells the very pearls are found, which the living animals of the same kind produce.

It is well known that the *purpura* and *pholades* have a long-pointed proboscis, which serves them as a kind of gimblet or drill, to pierce the shells of living fish on whose flesh they feed. Now, shells thus pierced are found in the earth, which is another incontestable proof that they heretofore inclosed living fish, and that these fish inhabited places where the *purpura* and *pholades* preyed on them.

In Holland sea shells are found 100 feet below the surface; at Marly-la-Ville, six leagues from Paris, at 75; and in the Alps and Pyrenean mountains they are found under beds of stone of 100, nay even 1000 feet.

Shells are likewise found in the mountains of Spain, France, and England, in all the marble quarries of Flanders, in the mountains of Guelders, in all the hills round Paris, in those of Burgundy and Champagne; and, in short, in all places where the basis of the soil is neither freestone nor sandstone.

By shells we would be understood to mean, not only those which are merely testaceous, but the relics of the crustaceous fishes also; and even all other marine productions; and we can venture to assert, that, in the generality of marbles, there is so great a quantity of marine productions, that they appear to surpass in bulk the matter whereby they are united.

Among the many instances of the multiplicity of oysters, there are few more extraordinary than that immense bed which M. de Reaumur gives an account of, which contains 130,630,000 cubic fathoms. This vast mass of marine bodies is in Touraine in France, at upwards of 36 leagues from the sea. Some of these shells are found so entire, that their different species are very distinguishable.

Some of the same species are found recent on the coast of Poictou, and others are known to be natives of more distant parts of the world. Among them are likewise blended some fragments of the more strong parts of sea plants, such as *madripores*, *fungi marini*, &c. The canton of Touraine contains full nine square leagues in surface, and furnishes these fragments of shells wherever you dig.

Near Reading in Berkshire, a continued body of oyster shells has been found: they lie in a stratum of greenish sand, about two feet in thickness, and extend over five or six acres of ground; they are covered by strata of sand and clay, upwards of 14 feet deep. Several whole oysters are found with both their valves or shells lying together, as oysters before they are opened; the shells are very brittle; and in digging them up, one of the valves will frequently drop from its fellow. Several are dug out entire; nay, some double oysters with their valves united.

In a quarry at the east end of Broughton in Lincolnshire, innumerable fragments of the shells of shell fish, of various sorts, are found under a stratum of stone imbedded in clay, with pieces of coral, and sometimes whole shell fish, with their natural shells and colours: some are most miserably cracked, bruised, and broken; others totally squeezed flat by the incumbent weight of earth.

Sharks teeth are dug up in the isle of Sheppey, retaining their natural colour, not petrified.

The teeth of sharks have likewise been taken out of a rock in Hendershelf park, near Malton in Yorkshire.

In the isle of Caldey, and elsewhere about Tenby in Pembrokeshire, marine fossils have been found in solid marble, on the face of the broken sea cliffs, 200 fathoms below the upper surface of the rocks. Nor were they only observed upon the face of these rocks, but even more or less throughout the whole mass or extent of them. This is manifest from divers rocks hewn down by workmen for making of lime, and other pieces casually fallen from the cliffs.

Thousands of fossil teeth, exactly answering to those of divers sorts of sea fish, have been found in quarries and gravel pits about Oxford.

At Tame in Oxfordshire, the *belemnites*, or *thunderbolt stones*, are found in a stratum of blue clay, which still retain their native shelly substance.

The *belemnites* found in gravel pits, have suffered much, by their being rubbed against each other in the fluctuation of waters.

The *nautili* and *belemnites* are frequently found at Gorsing near Oxford *.

One of the most extraordinary collections of shells is that

* Phil. Trans. vol. liv. p. 5.

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that lately discovered by Ramond on the summit of Mont Perdu, the highest of the Pyrenees, where there are found vast quantities of sea shells and other marine spoils, and even skeletons of animals in a fossil state.

Whole skeletons of very large animals have been discovered in a fossil state. Those of elephants have been found buried in the plains of Siberia; and bones of the rhinoceros, the hippopotamus, and the tapir, have been found in other places. A very large skeleton, nearly complete, of an immense animal, similar to the rhinoceros, is preserved in the cabinet of Madrid. It was dug up at Paraguay in South America, at the depth of 100 feet, in a sandy bed, on the banks of the river de la Plata. A description and engraving of it are given by Cuvier, in the Annals of the National Museum, N° 29. It appears to be at least 12 feet long, and the bones are of an immense size.

A prodigious quantity of fossils, both of marine animals, and of quadrupeds, are found in the plaster hills of Montmartre near Paris. An account of these has lately appeared in several numbers of the Annals of the National Museum, by M. Lamarck, accompanied with the anatomical illustrations of Cuvier. These papers are extremely curious, and contain engravings of most of the fossils described, some of which are the remains of unknown animals. Our limits do not permit us to present our readers with even an abstract of these accounts. We shall therefore select only one example.

Fig. 10. represents a block of gypsum, on the surface of which is the skeleton of an animal resembling a mouse, or, according to Cuvier, one of the opossum tribe. The skeleton is nearly entire, and the head, the neck, the spine, the pelvis, one of the fore and hind legs, and part of the tail, are very distinct. There were two pieces of gypsum found together, which appear to have divided the skeleton between them. The animal seems to have been crushed or imbedded in his natural situation *.

* Ann. du Mus. N° xxix. p. 277.

We have now enumerated the principal materials that compose the external crust of our earth, and have mentioned some of the most material circumstances respecting each. The metallic ores still remain to be considered, and they shall be noticed in describing metallic veins.

General Distribution of Materials of the Earth.

Chap. II. *General Distribution of the Materials of the Earth.*

The uppermost stratum of the earth, in low situations, is, for the most part, composed of sand or clay, or a mixture of these, forming beds that are either composed of the same mixture, or of alternate layers of the two substances. These beds vary in thickness, in different places; but, in the same place, they usually preserve nearly the same thickness for a considerable extent. Sometimes these beds of clay, sand, and earth, with shells, extend to the depth of some hundred feet. See the annexed table, I. (E).

This table exhibits a view of the arrangement of strata in several countries of Europe; and, with the tables of coal strata, in the last chapter, will give the reader more information on this subject than an elaborate detailed account.

(E) The following works are referred to in the table of strata.

* Varenii Geogr. Gener. lib. i. prop. vii.
† Buffon, Nat. Hist. vol. i. art. vii.
‡ Bergman, Descript. Phys. de Terre, sect. viii.
|| Kirwan, Geolog. Essays, p. 259.
§ Guettard, Atlas Mineral. de la France.
¶ Whitehurst's Theory of the Earth, sect. xvi.
** Ib. sect. xix.

TABLE.

TABLE of the order of Strata in Various Parts of Europe.

N° of Strata.	1 * Strata at Amsterdam.	Feet.	2 † At Marly la Ville, France.	Ft.	In.	3 ‡ Gravesend in Kent.	Ft.	In.	4 ‖ Mansfield in Germany.	Ft.	In.	5 § Hills near Etampes in France.	Ft.	In.	6 ¶ Strata of Derbyshire.	Ft.	In.	7 ** At Balleycastle, Ireland	Ft.	In.
1	Soil,	7	Earth, mud & sand,	13	0	Sand and flints,	1	3	Vegetable earth,			Vegetable earth,	4	0	Coarse sandstone,	360	0	Whinstone,		
2	Turf,	9	Earth and gravel,	2	6	Red sand,	0	10	Swinestone,	36	0	Marl and turf cut by dykes,	135	0	Slate clay,	360	0	Firestone,		
3	Soft clay,	9	Mud and sand,	3	0	Sand and flints,	1	8	Gypsum,	24—180	0	Of freestone, marl, and shells,	12	0	Shelly limestone,	150	0	Shale,		
4	Sand,	8	Hard marl,	2	0	Red sand,	0	10	Clay, chalk, and sand,	72—120	0	Brown pebbles,	4	0	Amygdaloid,	48	0	Stony clay,		
5	Earth,	4	Marly stone,	4	0	Sand and flints,	2	6	Compact limestone,	12	0	Marl and shells,	0	6	Compact limestone,	150	0	Shale,		
6	Clay,	10	Powdery marl with sand,	5	0	Pure sand in beds,	1	8	Argilliferous limestone,	3	0	Sand and grit,	45	0	Amygdaloid,	138	0	Freestone,		
7	Earth,	4	Sand,	1	6	Blackish clay,	0	4	Indurated clay,	0	1	Sand and rounded pebbles,	18	0	Lamellar limestone,	180	0	Stony clay,		
8	Sand,	10	Marl and sand,	3	6	Chalk and flints,	1	0	Calciferous clay,	4	6	Sand and shells,	6	0	Amygdaloid,	66	0	Shale,		
9	Clay,	2	Hard marl and flint,	3	6	Clay, sand, flints, and shells,	1	3	Clay slate,	1	4	Sand & gravel,	16	0	Limestone not cut through,			Limestone,		
10	White sand,	4	Gravel or marl in powder,	1	0	Fine yellow sand,	4	4	Marlite,	1	0	Turf and shells,	4	0	. . .			Coal,		
11	Earth,	6	Eglantine,	1	6	. . .			Sand,	0	1	Soft shale,	4	0	. . .			Indurated clay,		
12	Sand,	14	Marly gravel,	1	6	. . .			Gravel,	3	0	Marly clay,	8	0	. . .			Stony clay,		
13	Clay and sand,	8	Stony marl,	4	6	. . .			Blue clay,	2 in. to	8	. . .			. . .			Not ascertained,		
14	Sand & shells,	4	Sand and shells,	1	6	. . .			Sandstone, clay, & mica,	6	0	. . .			. . .			Coarse sandstone,		
15	Clay,	102	Gravel,	2	0	. . .			Red semiprotolite,	360	0							See fig. 1.		
16	Sand,	31	Stony marl,	3	6	. . .			Siliceous sandstone,	96	0									
17	. .		Powder marl,	1	6	. . .			Cragg-stone,	10	6									
18	. .		Hard stone,	1	0	. . .			Wacken,	156	0									
19	. .		Sand and shells,	18	6	. . .			Clay slate,	4	6									
20	. .		Brown freestone,	3	0	. . .			Coal,	4	6									
21	. .		Sand,	22	6	. . .			Clay slate,	3	0									
22									Slaty trap,	90	0									
23									Red semiprotolite,	180	0									
24									Primitive rock,	0	0									
Total N° of Feet.		232		100	0		15	0		256	6									

General Distribution of the Materials of the Earth.

In our subsequent view of the distribution of the stony matters that compose the earth, we shall consider,

1. The nature, disposition, and structure, of mountains.
2. The nature, direction, &c. of dykes.
3. The nature, direction, &c. of metallic veins.

Sect. I. *Of Mountains.*

112 Definition of mountains. There are no objects on the surface of the earth which are so well calculated to excite the attention of mankind in general, and that of geologists in particular, as those stupendous elevated masses which we call *mountains*. The term mountain has in general been applied to those parts of the earth which are elevated to a very considerable height above the level surface; and a mountain is in common language distinguished from a hill only by its superior elevation. But as it is found necessary in a scientific point of view to render this distinction more accurate and precise, various geologists have given more correct definitions. By Pini and Mitterpachter every elevation whose declivity makes with the horizon an angle of at least 13°, and whose perpendicular height is not less than one-fifth of the declivity, is called a *mountain*. Werner distinguishes mountains according to their height, into *high*, *middle-sized*, and *low*. A *high* mountain according to him is that whose perpendicular height exceeds 6000 feet; when the height is not above 6000 nor below 3000 he calls it *middle-sized*; and when its height is below 3000 feet, he calls it *low*.

113 Mountains are either single or in groups; and these groups either consist of several mountains standing near each other so as to occupy nearly the centre of a certain space of ground, or they follow each other so as to form a ridge or chain, running across a country, or along its shores. Sometimes these chains run in a longitudinal direction, as is the case with Mount Caucasus and the Uralian mountains in Asia, the Cordilleras in South America, &c. but often they run in a curvilineal direction like a crescent, as the Carpathian mountains, which separate Hungary from the rest of the Austrian territories. It has been supposed by some theoretic writers, that chains of mountains always run in nearly the same direction, which has been conceived to be from east to west; but this is by no means exact, as later observations have shewn that they assume different directions according to the form of the country where they are situated. Some writers have laid it down as a general rule, that chains of mountains always extend in a direction nearly parallel to the length of the country; but to this there are also many exceptions. Thus the Uralian mountains, the Carpathians, the Pyrenees, the Grampians in Scotland, and many others, run rather across the country. It often happens that mountains occupy nearly the central parts of a country; and the land generally slopes with a gentle declivity towards one side of the chain, while towards the other it is considerably steeper. This circumstance of one side of a chain of mountains being steeper than the other, has been lately extended to mountains and hills in general; and Dr Kirwan has written an excellent paper on the the subject, from which we shall here extract the most important observations.

"That one part of almost every high mountain or hill is steeper than another, could not have escaped the notice of any person who had traversed such mountains; but that nature in the formation of such declivities had any regard to different aspects or points of the compass, seems to have been first remarked by the celebrated Swedish geologist Mr Tilas, in the 22d vol. of the Memoirs of Stockholm for 1760. Neither Varenius, Lulolph, nor Buffon in his natural history published in 1784, have noticed this remarkable circumstance. 114 Kirwan's observations on the declivities of mountains.

"The observation of Tilas, however, relates only to the extreme ends, and not to the flanks of mountains; with respect to the former, he remarked that the *steepest* declivity always faces that part of the country where the land lies lowest; and the gentlest, that part of the country where the land lies highest: and that in the southern and eastern parts of Sweden they consequently face the east and south-east; and in the northern the west. The essential part of this observation extends therefore only to the general elevation or depression of the country, and not to the bearings of their declivities. 115 The steep side faces the low country.

"The discovery that the different declivities of the flanks of mountains bear an invariable relation to their different aspects, seems to have been first published by Mr Bergman in his Physical Description of the Earth, of which the second edition appeared in 1773. He there remarked, that in mountains that extend from north to south, the western flank is the *steepest*, and the eastern the *gentlest*. And that in mountains which run east and west the southern declivity is the steepest, and the northern the gentlest. Vol. II. § 187. 116 Western side the steepest.

"This assertion he grounds on the observations related in his 1st vol. § 32. namely, that in Scandinavia, the Suevoberg mountains that run north and south, separating Sweden from Norway, the western or Norwegian sides are the steepest, and the eastern or Swedish, the most moderate; the verticality or steepness of the former being to that of the latter as 40 or 50 to 4 or 2.

"That the Alps are steeper on their western and southern sides than on the eastern and northern.

"That in America the Cordilleras are steeper on the western side, which faces the Pacific ocean, than on the eastern. But he does not notice a few exceptions to this rule in particular cases which will hereafter be mentioned.

"Buffon, in the first volume of his Epochs of Nature, published in 1778, p. 185. is the next who notices the general prevalence of this phenomenon, as far as relates to the eastern and western sides of the mountains that extend from north to south; but he is silent with respect to the north and south sides of the mountains that run from east to west; nay, he does not seem to have had a just comprehension of this phenomenon; for he considers it conjointly with the general dip of the regions in which these mountains exist. Thus he tells us, vol. i. p. 185, that in all continents the general declivity, taking it from the summit of mountains, is always more rapid on the western than on the eastern side; thus the summit of the chain of the Cordilleras is much nearer to the western shore than to the eastern; the chain which divides the whole length of Africa, from the Cape of Good Hope, to the mountains of the Moon, 117 Remark of Buffon.

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Moon, is nearer, he says, to the western than to the eastern seas; of this, however, he must have been ignorant, as that tract of country is still unknown.

"The mountains which run from Cape Comorin through the peninsula of India are, he says, much nearer to the sea on the east than on the west; he probably meant the contrary, as the fact is evidently so, and so he states it in vol. ii. p. 295; the same he tells us may be observed in islands and peninsulas, and in mountains.

"This remarkable circumstance of mountains was notwithstanding so little noticed, that in 1792 the author of an excellent account of the territory of Carlsbad in Bohemia, tells us he had made an observation, which he had never met with in any physical description of the earth, namely, that the southern declivity of all mountains was much steeper than the northern, which he proves by instancing the Erzgebirge of Saxony, the Pyrenees, the mountains of Switzerland, Savoy, Carinthia, Tyrole Moravia, the Carpathian, and Mount Hæmus in Turkey. 2. *Bergm. Jour.* 1792. p. 385. in the note.

8 Of Herman.

"Herman in his geology, published in 1787, p. 90. has at least partially mentioned this circumstance; for he says that the eastern declivities of all mountains are much gentler and more thickly covered with secondary strata, and to a greater height, than the western flanks, which he instances in the Swedish and Norwegian mountains, the Alps, the Caucasian, the Apennine, and Ouralian mountains; but the declivities bearing a southern or northern aspect he does not mention.

9 Of Lametherie.

"Lametherie, in vol. iv. of his Theory of the Earth, of which the second edition appeared in 1797, a work which abounds in excellent observations, p. 381. produces numerous instances of the inequality of the eastern and western declivities, but scarce any of the northern and southern, whose difference he does not seem to have noticed; but he makes a remark which I have not seen elsewhere, that the coasts of different countries present similar declivities.

"With regard to eastern and western aspects, he thinks that a different law has obtained in Africa from that which has been observed in other countries; for in that vast peninsula he imagines the eastern declivities of mountains are the steepest, and the western the gentlest. Of this, however, he adduces no other proof, but that the greatest rivers are found on the western side: this proof seems insufficient, as, if mountains be situated far inland, great rivers may flow indiscriminately from any side of them, and sometimes few rivers flow even from the side whose descent is most moderate; for instance, from the eastern side of the mountains of Syria. The Elbe and the Oder, two of the greatest rivers in Germany, take their course from the western sides, the first of the Bohemian and the other of the Moravian mountains, which yet are the steepest. Many originate from lakes, as the Shannon with us; many take such a winding course, that from a bare knowledge of the place of their disemboguement it is impossible to judge from what side of a mountain they issue, if from any; their course at most discovers the depression of the general level of the country.

"In 1798, the celebrated traveller and circumnavigator, John Reinhold Foster, published a geological tract which merits so much more attention, as all the facts were either observed by himself, or related to him by the immediate observers. In this he states as a fact universally observed, that the south and south-east sides of almost every mountain are steep, but that the north and north-west sides are gently covered and connected with secondary strata, in which organic remains abound, which he illustrates by various instances, some of which have been already, and others will presently be mentioned.

120 South and south-east sides of mountains steepest.

"At present this fact attracts the greatest attention, being obviously connected with the original structure of the globe, and clearly proving that mountains are not merely fortuitous eruptions unconnected with transactions on the surface of the earth, as has of late been confidently advanced.

121 Account of mountains.

"I shall now state the principal observations relative to this object, that have been made in different parts of the world.

In Europe.

122 In Europe.

1. The mountains that separate Sweden from Norway extend from north to south, their western sides are *steep*, and the eastern *gentle*. 1. *Berg. Erde Beschreib.* p. 157.

2. The Carpathian mountains run from east to west; their southern sides towards Hungary are steep, their northern towards Poland moderate. *Foster*, § 46.

3. Dr Walker, professor of natural history at Edinburgh, observed that the coasts and hills of Scotland are steeper and higher on the western side than on the eastern. Jameson's Mineralogy of Scotland, p. 3. However, Jameson observed, that the south side of the isle of Arran is the lowest, and the north side the highest, p. 51.

4. The mountains of Wales are gentle on the eastern and steep on the western side.

5. The mountains of Parthery, in the county of Mayo, are steep on the western side.

6. The mountains which separate Saxony from Bohemia, descend gently on the Saxon or northern side, but are steep on the Bohemian or southern side. *Charpente*, p. 75. The southern declivity is to the northern as six to two. *Bergm. Journ.* 1792, p. 384. and 385.

7. The mountains which separate Silesia from Bohemia run nearly from east to west, yet are steeper on the northern or Silesian side than on the opposite Bohemian. *Assemanni Silesia*, 335. Such branches as run from north-east to south-west, have their western covered with primordial strata, and consequently less steep, 4. *New Roz.* p. 157.

8. The Meissener in Hessia is steeper on the north and east sides, which face the Warra, than on the south and western. 1. *Bergm. Journ.* 1789, p. 272.

9. The mountains of the Hartz and Habischtswald are steep on the south, and gentle on the northern sides, *Foster*, § 46.

10. The Pyrenees, which run from east to west, are steeper on the southern or Spanish side. *Carbonieres*, xiii.

11. The mountains of Crim Tartary are gentle on the northern, and steep on the southern sides. *Foster*, ibid.

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123 In Asia.

In Asia.

12. The Ourals, which stretch from north to south, are far steeper on the western than on the southern sides. *Herman Geologie*, p. 90.; and, 2. *Ural. Beschreib*, p. 389.

13. The mountain of Armenia, to the west of the Ourals, is steep on its east and north sides; but gentle on the southern and western. 1. *Pallas Voy.* p. 277.

14. The Altaischan mountains are steep on their southern and western sides, but gentle on the northern and eastern. *Foster*, ibid. and *Herman*. 2. *Ural Beschreib*, p. 390. in the note.

15. So also are the mountains of Caucasus. 3. *Schrift. Berl. Gelasch.* 471.

16. The mountains of Kamtschatka are steep on the eastern sides. *Pallas*, 1. *Act. Petropol.* 1777. p. 43.

17. The Ghauts in the Indian peninsula are steep on the western side.

18. The mountains of Syria, which run from north to south, skirting the Mediterranean, are said to be steeper on the western side, facing the Mediterranean. 4. *La Metherie*, p. 380.

In America.

"The Cordilleras run from north to south; their western flanks towards the Pacific are steep, their eastern descend gradually.

"In Guiana there is a chain of mountains that run from east to west; their southern flanks are steep, their northern gentle. *Voyages de Condamine*, p. 140."* 124 In America.

The theory according to which Mr Kirwan attempts to explain the appearances of mountains which are enumerated above, will be given in the next chapter.

We have already, under the article BAROMETER, N° 44. shewn the method of computing the height of mountains by means of that instrument. The following table shews the height of the principal mountains in the globe, chiefly according to this computation. 125 Height of mountains.

In this table the second column shews the height as estimated by the barometer, and the third the same by geometrical calculation. Where the numbers are placed in the middle of these two spaces, it denotes an uncertainty by what method the computation has been made.

* Nicol. Journ. vol. iv. p. 256.

TABLE of the Heights of Mountains, according to the latest computations.

<table>
<tr><th>Mountains.</th><th>Height by Barom.</th><th>Height by Geometry.</th></tr>
<tr><td>In Britain.</td><td>Feet.</td><td>Feet.</td></tr>
<tr><td>Ben Nevis,</td><td>4350</td><td></td></tr>
<tr><td>Whirn,</td><td>4050</td><td></td></tr>
<tr><td>Ben Lawers,</td><td colspan="2">4015</td></tr>
<tr><td>Ingleborough,</td><td>3987</td><td></td></tr>
<tr><td>Do.</td><td>2377</td><td>2380</td></tr>
<tr><td>Ben More,</td><td colspan="2">3903</td></tr>
<tr><td>Pennygent,</td><td>3930</td><td></td></tr>
<tr><td>Crossfell,</td><td colspan="2">3839</td></tr>
<tr><td>Skiddaw,</td><td>3380</td><td>3530</td></tr>
<tr><td>Snowden,</td><td>3456</td><td></td></tr>
<tr><td>Mount Battock,</td><td colspan="2">3465</td></tr>
<tr><td>Pendlehill,</td><td>3411</td><td></td></tr>
<tr><td>Schehallion,</td><td colspan="2">3564</td></tr>
<tr><td>Helvellyn,</td><td>3324</td><td></td></tr>
<tr><td>Hartfell,</td><td>3300</td><td></td></tr>
<tr><td>Ben Wevis,</td><td colspan="2">3700</td></tr>
<tr><td>Ben Lomond,</td><td>3240</td><td></td></tr>
<tr><td>Saddleback,</td><td>3048</td><td></td></tr>
<tr><td>Ben Ledy,</td><td colspan="2">3099</td></tr>
<tr><td>In Ireland.</td><td></td><td></td></tr>
<tr><td>Slieve Donard,</td><td>3150</td><td></td></tr>
<tr><td>Croagh Patrick,</td><td>2666</td><td></td></tr>
<tr><td>Nephin,</td><td>2640</td><td></td></tr>
<tr><td>Knock Meledown,</td><td>2700</td><td></td></tr>
<tr><td>Mangerton,</td><td></td><td>2500</td></tr>
<tr><td>Cumeragh,</td><td>2160</td><td></td></tr>
<tr><td>In France.</td><td></td><td></td></tr>
<tr><td>Puy de Sansi,</td><td colspan="2">6300</td></tr>
<tr><td>Plomb de Cantal,</td><td colspan="2">6200</td></tr>
<tr><td>Puy de Dome,</td><td colspan="2">5000</td></tr>
</table>

<table>
<tr><th>Mountains.</th><th>Height by Barom.</th><th>Height by Geometry.</th></tr>
<tr><td>Pyrenees.</td><td>Feet.</td><td>Feet.</td></tr>
<tr><td>Mont Perdu,</td><td>11,000</td><td></td></tr>
<tr><td>Canigou,</td><td>9,000</td><td></td></tr>
<tr><td>Alps.</td><td></td><td></td></tr>
<tr><td>Mont Blanc,</td><td>15,662</td><td></td></tr>
<tr><td>Schrekhorn,</td><td colspan="2">13,000+</td></tr>
<tr><td>Finsteraar,</td><td colspan="2">12,000+</td></tr>
<tr><td>Mount Titlis,</td><td colspan="2">10,818</td></tr>
<tr><td>Mont Rosa,</td><td colspan="2">15,000</td></tr>
<tr><td>Mont Cenis,</td><td colspan="2">9,760</td></tr>
<tr><td>In the Tyrol,</td><td></td><td></td></tr>
<tr><td>Glochner,</td><td colspan="2">11,500 Fr.</td></tr>
<tr><td>Ortele,</td><td colspan="2">13,000 Fr.</td></tr>
<tr><td>Plaley Kogel,</td><td colspan="2">9,748 Fr.</td></tr>
<tr><td>Germany.</td><td></td><td></td></tr>
<tr><td>Stuben,</td><td colspan="2">4692</td></tr>
<tr><td>Brenner</td><td colspan="2">5109</td></tr>
<tr><td>Lomnitz peak, } Carpath.</td><td colspan="2">8640</td></tr>
<tr><td>Kesmark peak, } Carpath.</td><td colspan="2">8508</td></tr>
<tr><td>Krivan, } Carpath.</td><td colspan="2">8343</td></tr>
<tr><td>Sicily.</td><td></td><td></td></tr>
<tr><td>Ætna,</td><td colspan="2">10,032</td></tr>
<tr><td>In Denmark, Norway, and Sweden.</td><td></td><td></td></tr>
<tr><td>Swukku,</td><td colspan="2">9000</td></tr>
<tr><td>Areskutan,</td><td colspan="2">6162</td></tr>
<tr><td>Kinneculla,</td><td colspan="2">931</td></tr>
<tr><td>Rœtack,</td><td colspan="2">6000</td></tr>
</table>

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TABLE of the Heights of Mountains, Continued.

Mountains.	Height by Barom.	Height by Geometry.
	Feet.	Feet.
In Russia.		
Pauda,		4512
Canary Islands.		
Peak of Teneriffe,	11,424	
In North America.		
Stony Mountains,	3000	
White Mountains,	4000	
Blue Mountains,	2000	
South America.		
Chimborazo,		20,280
Do.	20,910	
Cotopaxi,		18,600
Tunguragas,	16,170	
In Jamaica.		
Blue Mountains,	7431	

26 Course of mountains. The course of mountains is that direction of their length in which they descend and grow lower; or if a river runs parallel to them, they are said to have their course in the direction of the stream of the river. The course of mountains is seldom uniform. It has been laid down as a general maxim by Buffon, that when there are two parallel chains of mountains, the salient angle of one of the chains always corresponds with the internal angle of the other; but later geologists have ascertained that this circumstance does not generally hold, except when a river runs between the two chains.

27 Composition of mountains. It generally happens, that one particular mountain, or chain of mountains is composed of those stony materials which we have denominated primitive; while the rest is made up of the secondary componnds. The primitive substances occupy the base and central parts of the mountain, and often extend to its very summit: the secondary cover these, and are generally found on the flanks or sides of the mountain, though sometimes they cover the top of the mountain. In a chain of mountains there are commonly three, and often five parallel ridges, of which the central ridge is composed of primitive compounds, and those on each side of it, chiefly or entirely of secondary compounds. Hence mountains are usually divided into primary or primeval, and secondary or epizootic; the latter term being given to the secondary mountains from their being replete with shells and other remains of animal beings. The secondary mountains are also sometimes divided into original and derivative, for a reason that will appear hereafter.

28 Distinction of primary and secondary mountains. The primary mountains, besides their being in the centre, and destitute, or nearly so, of organic remains, may generally be distinguished by the ruggedness and angular appearances arising from the different nature and hardness of the substances of which they are composed; the quartz and harder granite resisting the attacks of the air and weather, while the other substances being softer, gradually decay, and leave the harder in the form of spires and angles. Where, however, the primitive compounds have been completely covered with secondary strata, these angular appearances seldom take place; and the mountain is only to be distinguished by its position and the structure of its internal parts. The secondary mountains generally have their tops round, and much smoother than those of the primary mountains.

In some cases a number of mountains appear united at their tops into an extensive plain or platform, from which they seem to diverge and branch in every direction. The most remarkable instance of this kind occurs in Tibet. (See GEOGRAPHY, N° 41.).

It is difficult to acquire a knowledge of the interior structure of mountains. The greater part of them is hid from our view, and nature only exposes them in a few points by means of fissures, caverns, and intermediate valleys.

"The materials of which mountains consist are disposed either in irregular heaps, or piles variously intersected by rifts, or in beds or strata separated from each other by rifts, often horizontal, or varying from that direction by an angle of from 5 to 40 degrees, and sometimes much more considerably, approaching even to a vertical position. The strata of mountains are most frequently in the direction of their declivity, yet sometimes their course is directly opposite, or countercurrent: the best manner of determining the angles of their course is by discovering that of their rifts. It chiefly depends on the unevenness of the fundamental gronnd that supports them. According to 1 Sauss. 502. most of the elevated granitic mountains in Swisserland are formed of immense vertical pyramidal laminæ, parallel to each other, that is, piles somewhat inclining from the unequal distribution of their weight, a disposition that may well be expected from collateral crystallizations; but this disposition is not universal, for they have been found in Saxony, and in the Pyrenees, horizontally stratified; much less can it be said, that this vertical position is general, for the strata of gneiss are generally horizontal, and commonly very regular, discovering no traces of a violent shock. Mount Rosa, next to Mount Blanc, the highest in Europe, consists also of gneiss, which M. Saussure found horizontally stratified.

"Shangin, who lately (1786) travelled over the Altaischan mountains, being consulted by Pallas, whether he found any vertical layers or strata therein, answered, he had not; but that he found them perfectly horizontal on the banks of the river Tschary.

"Mountains of primitive limestone are frequently in irregular piles, but often also horizontally stratified. Siliceous schistus is also often horizontally stratified. Many

General Distribution of the Materials of the Earth.

Many argillites, particularly roof slates, are generally said to have nearly a vertical position: but Voight has shewn that it is only their lamellæ that are so situated; their horizontal seams, and their walls, discovering their true position; their verticality arising only from the drain of the water, and, consequently, their contraction in that direction: hence those that are most silicited, as they contract less, discover less verticality. Sometimes horizontal strata overlap on both sides. Sometimes they are flanked on both sides with vertical strata.

"Much confusion prevails in the structure of the Pyrenees, and of the Grison mountains, and those on the borders of the Baikal, and other great lakes.

"The perturbed state of the strata often proceeds from the decomposition of internal beds of pyrites, to which water has had access; this appears to be the cause of the alterations observed in the mountain of Rabenberg, on the frontiers of Saxony. In this mountain a double direction of the strata of gneiss is observed; between both the strata are vertical, and a large intermediate space is filled with iron ore: but this mountain contains beds of pyrites and vast swallows; most probably then the pyrites swoll, uplifted the whole, and the dissolved iron flowed into the vacuity, from which the water afterwards drained off on the sides.

"In secondary mountains, particularly the calcareous, the greatest disorder often prevails, though in general their stratification is horizontal.

"The calcareous mountains of Savoy are often arched like a *lambda*, probably from the sinking of the intermediate strata, the intermediate remaining horizontal. Sometimes they assume the form of the letters Z. S. C. or of a disjointed ƆC, the convexities facing each other. So also in the Pyrenees, they sometimes overlap, from an unequal distribution in their original formation, and bend various ways. They assume a spiral form, or that of a horse-shoe placed horizontally.

"According to Lehman, most secondary strata present hollows or *moulds*, (as they are called,) from internal depression. But sometimes also *elevations*, from an original elevation in the fundamental stone.

"In Scotland, all the secondary strata in the vicinity of primeval mountains, are nearly vertical; but at a greater distance they approach more to an horizontal direction *."

* *Kirwan's Geological Essays*, p. 281.

We shall now trace the course of the principal mountainous chains on the globe, and in accompanying us, the reader may have before him a good map of the world.

129 Equatorial mountains not the highest.

M. Buache places the most elevated points of the great chains of mountains under the equatorial line: but, according to Pallas, the fullest and most continuous lands, and perhaps likewise the most elevated, are to be found at a distance from the equator, and towards the temperate zones. If, in fact, we survey the globe's surface, we shall not be able to perceive that chain of mountains, which running from east to west, and dividing the earth into two portions, ought again to meet. On the contrary, extensive plains seem to accompany the line through almost its whole extent. In Africa, the deserts of Nigritia and those of Upper Ethiopia are on the one side of the line; and on the other are the sandy plains of Nicoco, Caffraria, Monemugi, and Zanguebar. From the eastern shores of Africa to the Sunda islands, is a space of 1500 leagues of sea with almost no islands, except the Laccadive and Maldive islands; most part of which have little elevation, and which run from north to south. From the Molucca islands and New Guinea, to the western borders of America, the sea occupies a space of 3000 leagues. Though Chimboraço and Pichincha in America, the two highest mountains which have been measured, are near and even under the line, yet from this no conclusion can be drawn; because on one side these mountains run in a direction not parallel to the equator; the Andes or Cordilleras attain a greater elevation as they remove from the equator towards the poles; and a vast plain is found exactly under the line, between the Oroonoko and the river of the Amazons. Besides, the latter river, which takes its rise in the province of Lima about the 11th degree of south latitude, after crossing the whole of South America from west to east, falls into the ocean exactly under the equator. This shows that there is a descent for the space of 12 degrees or 300 leagues. From the mouth of the river of the Amazons, to the western shores of Africa, the sea forms another plain of more than 50 degrees.

From the few certain facts and accurate observations which we have received from well informed travellers, we might almost affirm that the most elevated land on our globe is situated without the tropics in the northern and southern hemispheres. By examining the course of the great rivers, we in fact find that they are in general discharged into three great reservoirs, the one under the line, and the other two towards the poles. This, however, we do not mean to lay down as universally true; for it is allowed, that, besides the two elevated belts, the whole surface of the earth is covered with innumerable mountains, either detached from one another or in a continued chain. In America, the Oroonoko and the river of the Amazons run towards the line, while the river St Lawrence runs towards the 50th degree of north latitude, and the river de la Plata towards the 40th degree of south latitude. We are still too little acquainted with Africa, which is almost all contained within the tropics, to form any accurate conclusions concerning this subject. Europe and Asia, which form only one great mass, appear to be divided by a more elevated belt, which extends from the most westerly shores of France to the most easterly of China, and to the island of Sagaleen or Anga-hata, following pretty nearly the 50th degree of north latitude. In the new continent, therefore, we may consider that chain where the Mississippi, the river St Lawrence, the Ohio, and the river de los Estrechos, take their rise, as the most elevated situation in North America; whence the Mississippi flows towards the equator, the river St Lawrence towards the north-east, and the rest towards the north-west. In the old continent, the belt formerly mentioned, and to which we may assign about 10 degrees of breadth, may be reckoned from the 45th to the 55th degree of north latitude: for in Europe the Tagus, the Danube, the Dnieper, the Don and the Volga, and in Asia the Indus, the Ganges, the Meran, the Mecon, the Hoang-ho, and the Yang-tse-Kiang, descending as it were from this elevation, fall into the great reservoir between the tropics; whilst towards the north eneral stribu- of the terials f the arth.

north the Rhine, the Elbe, the Oder, the Vistula, the Oby, the Jenisei, the Lena, the Indigirka, and the Kowyma, are discharged into the northern reservoir.

Judging from those mountains the height of which has been calculated, and from the immense chains with which we are acquainted, we may infer that the highest mountains are to be found in this elevated belt. The Alps of Swisserland and Savoy extend through the 45th, the 46th, and the 47th degrees. Among them we find St Gothard, Furca, Bruning, Russ, Whiggis, Scheidek, Gunggels, Galanda, and lastly, that branch of the Swiss Alps which reaches Tirol by the name of Arlenberg and Arula. In Savoy, we meet with Mont Blanc, the Peak of Argentiere, Cornero, Great and Little St Bernard, Great and Little Cenis, Coupeline, Servin, and that branch of the Savoyard Alps which proceeds towards Italy through the duchy of Aost and Montferrat. In this vast heap of elevated peaks, Mont Blanc and St Gothard are particularly distinguished. The Alps, leaving Swisserland and Savoy, and passing through Tirol and Carniola, traverse Saltzbourg, Stiria, and Austria, and extend their branches through Moravia and Bohemia, as far as Poland and Prussia.—Between the 47th and 48th degrees, we meet with Grimming the highest mountain of Stiria, and Priel which is the highest in Austria. Between the 46th and 47th degrees, the Bacher and the Reinschnicken, form two remarkable chains. The upper one, which traverses the counties of Trencsin, Arrava, Scepus, and the Kreyna, separates Upper Hungary from Silesia, Little Poland, and Red Russia; the inferior one traverses Upper Croatia, Bosnia, Servia, and Transylvania, separates Lower Hungary from Turkey in Europe, and meets the upper chain behind Moldavia, on the confines of Little Tartary. In these mountains are situated the rich mines of Schemnitz.

To form a general idea of the great height of this Alpine belt, it is necessary only to remark, that the greatest depth of the wells at Schemnitz is 200 toises; and yet it appears from the barometrical calculations of the learned M. Noda, that the greatest depth of these mines is 286 toises higher than the city of Vienna. The granito-argillous mountains of Schemnitz, and of the whole of this metallic district, are inferior, however, to the Carpathian mountains. Mount Krivany in the county of Arrava, and the Carpathian mountains between Red Russia and the Kreyna, appear by their great elevation to rule over the whole of the upper Alpine chain. In the inferior chain we likewise meet with mountains of an extraordinary height; among others, Mount Mediednik, which gives its name to a chain extending far into Bosnia; and Mount Hemus, celebrated even among the ancients. In short, this extensive chain reaches into Asia, and is there confounded with another chain no less famous, which, following exactly the 50th degree of latitude, runs through the whole of Asia. This chain of mountains is described by Dr Pallas in the work above mentioned; and we shall now trace its course in company with this intelligent observer.

Uralian chain.

This author places the head of the mountains of Oural, between the sources of the Yaik and the Bielaïa, about the 53d degree of latitude, and the 47th of longitude. Here the European Alps, after having traversed Europe, and sent off various branches which we shall afterwards examine, lose their name, which is changed into that of the Ouralic or Uralian mountains, and begin their course in Asia. This lofty chain, which separates Great Bulgaria from the deserts of Ischimska, proceeds through the country of the Eleuths, follows the course of the river Irtis, approaches the lake Teleskaia, and afterwards forms a part of the same system of mountains with the Altaic chain. There they give rise to the Oby, the Irtis, and the Jenisei, which begin their course about the 50th degree of north latitude, and fall into the Frozen ocean.

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132 Altaic chain.

The Altaic chain, after having embraced and united all the rivers which supply the Jenisei, is continued under the name of *Saiunes*, without the smallest interruption, as far as the Baikal lake. The extension of this chain to the south forms that immense and elevated plain which is lost in Chinese Tartary, which may be compared with the only plain in Quito, and which is called *Gobi* or *Chamo*. The Altai afterwards interposing between the source of the Tchikoi and of the rivers which supply the Amur or Sagaleen, rises towards the Lena, approaches the city Jakuck beyond the 60th degree of latitude, runs from that to the sea of Kamtschatka, turns round the Ochockoï and Pensink gulfs, joins the great marine chain of the Kurile isles near Japan, and forms the steep shores of Kamtschatka, between the 55th and 60th degrees of latitude. After running in the same parallel, and giving rise to the Ohio, the Riviere Longue, the river St Lawrence, and the Mississippi, they are lost in Canada. From the eastern shores of America to the western shores of Europe, we find a vast interruption.

133 Alpine chain.

The European Alps produce three principal chains which run towards the equator, and some smaller ones running towards the pole. The first southern chain is sent out through Dauphine; traverses Vivarais, Lyonnois, Auvergne, Cevennes, and Languedoc, and, after joining the Pyrenees, enters Spain. There it divides into two or three ramifications, one of which runs through Navarre, Biscay, Arragon, Castile, Marche, and Sierra Morena, and extends into Portugal. The other, after traversing Andalusia and the kingdom of Granada, and there forming a number of mountains, again makes its appearance, beyond the straits of Gibraltar, in Africa, and coasts along its northern shores, under the name of *Mount Atlas*.—The second principal chain of the Alps passes out through Savoy and Piedmont; spreads its roughnesses over the states of Genoa and Parma; forms the belt of the Appennines; and after frequently changing its name, and dividing Italy into two parts, terminates in the kingdom of Naples and in Sicily, producing volcanoes in every part of its course. The third chain is sent off from Hungary, and scatters innumerable mountains over all Turkey in Europe, as far as the Morea and the Archipelago at the bottom of the Mediterranean sea. The northern branches, though smaller at first, are no less clearly defined; and some of them even extend their ramifications as far as the Frozen ocean. An Alpine branch, issuing from Savoy through the country of Gex, proceeds through Franche Comté, Suntgaw, Alsace, the Palatinate, and Veterabia.—

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Another issues from the territory of Saltzbourg, passes along Bohemia, enters Poland, sends off a ramification into Prussia towards the deserts of Waldow, and after having passed through Russia is lost in the government of Archangel.

134 Asiatic Alps.

The Asiatic Alps send forth in like manner several branches both to the south and north. The Ouralic mountains, between the sources of the Bielaia and the Jaik, produce three principal branches; the first of which, including the Caspian sea in one of its divisions, enters Circassia through the government of Astracan, passes through Georgia under the name of *Caucasus*, sends a vast number of ramifications to the west into Asiatic Turkey, and there produces the mountains, Tschilder, Ararat, Taurus, Argée, and many others in the three Arabias; while the other division, passing between the Caspian sea and the lake Aral, penetrates through Chorasan into Persia. The second branch, taking a more easterly direction, leaves the country of the Eleuths; reaches Little Bucharia; and forms the ramparts of Gog and Magog, and the celebrated mountains, formerly known by the name of *Caf*, which M. Bailly has made the seat of the war between the Dives and the Peris*. It traverses the kingdoms of Casgar and Turkestan, enters through that of Lahor into the Mogul territory, and, after giving rise to the elevated desert of Chamo, forms the western peninsula of India. While these two branches run towards the south, the third branch of the Ouralic chain rises towards the north, following almost the 79th degree of longitude, and forms a natural boundary between Europe and Asia; without, however, bounding the immense empire of Russia. This chain, after coming opposite to Nova Zembla, divides into two considerable branches. The one, running to the north-east, passes along the Arctic shores; the other, proceeding towards the north-west, meets the northern European chain, traverses Scandinavia in the shape of a horse shoe, covers the low lands of Finland with rocks; and, as is observed by Dr Pallas, appears to be continued from the North Cape of Norway through the marine chain of Spitzbergen, scattering islands and shelves perhaps throughout the northern ocean, that, passing through the pole, it may join the northern and eastern points of Asia and North America.

* *Lettres sur les Atlantides*, let. 16.

135 The Ouralic, which, in the country of the Mongols, becomes the Altaic chain, proceeds towards the equator. After forming the mountains and caverns wherein, as we are told, the ashes of the Mongol emperors of the race of Gengis-Kan are deposited, together with the vast plain of Chamo, consisting of arid sand, and the frightful rocks and precipices of Thibet, which form the mysterious and desert retreats of the Grand Lama, it crosses the rivers Ava and Menan; contains in its subdivisions the kingdoms of Ava, Pegu, Laos, Tonquin, Cochin-China, and Siam; supports the peninsula of Malacca; and overspreads the Indian ocean with the isles of Sunda, the Moluccas, and the Philippines. From the borders of the Baikal lake and of the province of Selinginskoy, a branch is detached, which spreads over Chinese Tartary and China, is continued into Corea, and gives rise to the islands of Japan.

The great chain having extended to the north, near the city of Jakuck, upon the banks of the Lena, sends off one of its branches to the north-west, which, passing between the two Tungusta, is lost in marshy grounds lying in the northern parts of the province of Jenisseiskoy. The same chain, after it has reached the eastern part of Asia, is lost in the icy regions of the north about Nos-Tschalatskoy, or the Icy Promontory, and Cape Czuczenskoy.

136 Southern elevation.

It will be more difficult, perhaps, to trace the elevated belt in the southern hemisphere beyond the tropic of Capricorn, than it has been to distinguish that towards the north. An immense extent of ocean seems to occupy the whole Antarctic part of the globe.—The greatest south latitude of the old continent is not more than 34 degrees, and South America scarcely extends to the 55th degree. In vain has the enterprising Cook attempted to discover regions towards the pole: his progress was constantly interrupted by tremendous mountains and fields of ice. Beyond the 50th degree no land and no habitations are to be found. The islands of New Zealand are the farthest land in these desert seas; and yet the south cape of Taral-Poenamoo extends only to the 48th degree: We do not mention Sandwich land, which is situated in the 58th degree, because it is too small and too low. It must be recollected, however, that, according to the declaration of travellers, the Cordilleras become higher as they advance southward to the straits of Magellan; and that Terra del Fuego, which lies in the latitude of 55, is nothing but a mass of rocks of prodigious elevation. America, however, exhibits to our view elevated points, whence chains of mountains are distributed in different directions over the whole surface of the new continent. There must likewise be great reservoirs, where the most remarkable rivers take their rise, and from which they necessarily descend towards their mouths. In the southern hemisphere, this elevated belt is nearer the equator; and though it does not extend to the 50th degree, it is evidently to be met with, and may be accurately traced, between the 20th and 30th degrees. The high mountains of Tucuman and of Paraguay, which intersect South America about the 25th degree of latitude, may be considered as the American Alps. If we look into the map of the world, we shall be able to distinguish an elevated belt all along this parallel. In Africa, Monomotapa and Caffraria are covered with very high mountains, from which pretty large rivers descend. In the Pacific ocean, we find New Holland, New Caledonia, the New Hebrides, and the Friendly and the Society islands, under the same parallel. We may, therefore, with sufficient propriety, distinguish this parallel by the name of the *Southern Alps*, as we have already distinguished the elevated belt of the 50th degree of north latitude by that of the *Northern Alps*. In America, the Rio de la Plata, which, after a course of 500 leagues, falls into the ocean at the 35th degree of south latitude; the Pavana, which rises from the mountains of the Arapes, and falls into the Plata at Corriente; the great number of rivers which flow into that of the Amazons, such as the Paraba, which receives in its course the tribute of more than 30 other rivers; the Madera, the Cuchirara, the Ucayal, &c. &c. all descend from these southern Alps. From these Alps likewise three considerable branches of mountains are detached, which eral tribu- of the erials the rth.

go by the common name of *Andes* or *Cordilleras.*— The first branch, which extends towards the south, and passes out from Paraguay through Tucuman, separates Chili from these provinces and from Chimito, and is continued through Terra Magellanica as far as Terra del Fuego. The second branch, directing its course towards the equator, traverses Peru, in vain endeavouring to conceal treasures which the avarice of men has taught them to discover in its bowels; bounds the Spanish Missions; enters Terra Firma through Popayan; and unites South and North America by the isthmus of Panama. The third division, issuing from Paraguay through Guayra and the territory of Saint Vincent, traverses Brazil, distributes ramifications into Portuguese, French, and Dutch Guiana, crosses the Oroonoko, forms the mountains of Venezuela, and near Carthagena meets the second branch coming from Popayan.

57 M tains of rth A ca.

We have already supposed, that the elevated belt of North America was situated about the 45th degree of north latitude; and there we imagined we recognized the continuation of the northern Alps of the old continent. This chain likewise sends forth considerable branches on both sides. One of them is detached across the sources of the Mississippi, the Belle Riviere, and the Missouri, and at the entrance of New Mexico divides, in order to form California to the west, and the Apalachian mountains to the east.— Thence proceeding through New Biscay, the audience of Guadalaxara, Old Mexico, and Guatimala, it meets at Panama the southern branch, which is part of the Alps of Paraguay. The second branch, following the course of the Mississippi, separates Louisiana from Virginia; serves as a bulwark to the United States of America; forms the Apalachian mountains in Carolina; and at last, traversing East Florida, encloses the gulf of Mexico with the Great and Little Antilles. In the north, we can trace the branches of the elevated belt; on one side observe them proceeding towards Canada, directing their course through Labrador to Hudson's Straits, and at length confounded with the rocks of Greenland, which are covered with eternal snow and ice. On the other side, we see them rising through the country of the Assinipoels and the Kristinos, as far as Michinipis and the northern Archipelago.

Briti moun ins.

In tracing the course and direction of the British mountains, we shall begin with the central chain, which runs through the southern part of the island from north to south, commencing at Geltsdale, about 14 miles to the south east of Carlisle, and ending at Land's End in Cornwall, or rather in the Scilly isles to the west of this. This chain passes from Geltsdale forest through the western districts of Durham and Yorkshire, forming the hills called Kelton Fell, Stanmore, Widehill Fell, Wildbore Fell, Bow Fell, Home Fell, Bun Hill, &c. A little to the west of the chain stand several detached mountains, the principal of which is Skiddaw in Cumberland. Passing through Yorkshire we find Craven, Whurnside, Ingleborough, and Pennygent; and on the east of Lancaster is Pendle. In this course there are several miles of coal and lead. The chain next proceeds through Derbyshire, and in this part of the ridge a great variety of valuable minerals are found, especially lead, copper, gypsum, fluor, barytic earths, martial pyrites, iron ore, manganese, and several ores of zinc. About this point the ridge stretches a little into Cheshire, and seems to terminate; a central chain of somewhat less elevation may, however, still be traced, proceeding in a waving direction towards Salisbury, and having three irregular branches, two to the east, and another running to the south-west into Cornwall. The first eastern branch proceeds towards Norfolk, and to this belong some considerable hills, especially those of Gog Magog in Cambridgeshire. The second branch passes into Kent, and diverges a little into Surry and Hampshire. The continuation of this chain is afforded by the hills of Mendip, Polden, Ledgemoor, and Blackdown in Somersetshire; the Tores and Wilds of Dartmore in Devonshire, and the upland Downs of Cornwall. Malvern hills in Worcestershire deviate a little from the chain, but those of Cotswold in Gloucestershire appear to be a continuation of it. The principal mineral found in this ridge of mountains, after leaving Derbyshire, is the tin ore of Cornwall.

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Wales contains many mountains, especially in its northern part, where Snowden is celebrated for its height and classical fame. The top of this mountain is formed almost into a point, and commands an extensive view, not only of the neighbouring counties, but of part of Scotland and Ireland, and the isles of Man and Anglesey. A line of mountains proceeds from Snowden along the western coast to Plinlimmon; and in this line lie Urrou Seth, Caeridris, and Moyle Vadiau. A few hills of little elevation proceed towards Shropshire, among which the Wrekin is the most remarkable. Another small chain proceeds south towards Cardiff, but contains no hills of any eminence. 139

140 Scotch mountains.

Leaving England, and proceeding towards the north, we find the Cheviot Hills, so celebrated in the history of the border skirmishes. These form a regular ridge, running from south-west to north-east, where they join the hills of Galloway. In this part of Scotland there are several mountainous ridges running in various directions, generally north and south according to the course of the rivers; but there is, properly speaking, no uniform chain. Dumfries-shire contains several mountains, some of which are of considerable height, especially Hartfell in Annandale, from which proceeds the celebrated chalybeate spaw; Lowther near Leadhills; Blacklaw on the borders of Ayrshire; Etrick Pen, in Eskdale moor; Carnkinnow near Drumlanrigg; and Queensberry hill, which gives the title to the dukedom of that name. Proceeding towards the north, we find Pentland hills, a little to the south-west of Edinburgh, and the romantic hills of Arthur's seat and Salisbury Craigs, in the immediate vicinity of that city. On the eastern coast, before crossing the Forth, is North Berwick Law, which must be considered as closing the list of southern hills in Scotland. The principal part of these southern hills consists of calcareous earth, and argillaceous schistus; and except in those of Galloway, granite and other primitive rocks are very sparing. In the Lothian hills the calcareous strata are surmounted by vast blocks of trap, wacke, and basalt.

On the north of the Forth are the hills of Ochil, of little elevation, but celebrated for affording large quantities of agates and chalcedonies. The hills of Kinnoul and Dunsinnan in the eastern part of Perthshire, are generally considered the last of the lowland hills.

The

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The principal northern chain of British mountains is that of the Grampian hills, extending from Loch Lomond to Stonehaven, and forming the southern boundary of the Highlands; and rising by a gradual transition from the Sidlaw hills on the east, the Campsey hills on the west, and the Ochils in the middle. The principal mountains of this chain are Ben Lawers, Ben More, Schehallion, Ben Vorlich, Ben Lomond, and Ben Ledy. Near Ben Lawers is Ben Nevis, the highest mountain in Britain, and to the north-west of this, near Fort Augustus, is the long hill of Corri Allok. About 30 miles to the east of this is the high mountain of Cairngorum, famous for the specimens of quartzose stones found there. Numerous mountains lie in the second divisions of the Highlands, beyond Loch Linne, and Loch Ness, especially on the western shore, which is crowded with hills. Few of these are considerable. To the west of Ross-shire are several hills, among which Ben Chat, Ben Chasker, and Ben Golich are the most remarkable. More inland stands the high mountain of Ben Wevis, nearly equal to Ben Nevis. In most of these mountains the primitive rocks prevail, and granite is often very abundant. Few minerals, however, except iron ore, are found.

141 Irish mountains.

Ireland contains but few mountains, and none of any considerable importance. They generally form short lines, or appear in detached groups, one of the highest of which is that on the west and south of the lake of Killarney, in which is the mountain of Mangerton. A small line of hills called Shecky mountains runs on the north-west of Bantry Bay, passing towards the east. To the northward of this stands Sliblogher and Nagles, and towards the east are the hills of Knockemdown. In the county of Leinster is a mountain of the same name, and to the south of Dublin are the Wicklow hills, from which there were lately such great expectations of golden treasure. In Ulster stand the mountains of Monrne, the highest of which, Donard, is said to be nearly the height of Mangerton. The most mountainous part of Ireland is the western peninsula of that island, towards which, in the county of Mayo, stands Nephin, one of the highest in the kingdom. On the south-east of Clewbay is the mountain of Croagh Patrick, also in the county of Mayo, which is the last Irish hill of any importance.

We cannot here with propriety enter on the theory of the formation of mountains. The hypothesis of the principal geological writers with respect to this subject, will be seen from the general view of the theories to be given in the next chapter. We may in this place only remark, that all the systems which have been constructed, to explain the formation of the primitive mountains, with respect to which there is the most dispute, may be reduced to three.

In the first of these, mountains are supposed to have been formed such as we now see them, except that they have suffered some degradations and modifications, from certain accidents posterior to their original formation, and that these mountains owed their elevation above the places which surround them, to one single accidental accumulation of more materials in one place than in another; an accumulation which might have taken place without that great precipitation which preceded and occasioned the consolidation of the crust of our globe.

In the second hypothesis, all the primitive mountains, are supposed to have been raised by one cause, and in one certain manner; and the materials which compose them, to have been thrown out of their natural position. It is with respect to this raising or displacement that geologists have imagined so many different hypotheses.

In the third general theory, these mountains are supposed to have become pre-eminent from the accidental lowering or removal of the materials which originally surrounded them, whether this happened from the materials composing these mountainous situations having suffered no displacement, or that they had been themselves removed.

M. Dolomieu is of opinion, that there are mountains whose situation and structure favour each of these three hypotheses *.

* Journ. de Min. [illegible] xlii. p. [illegible]

Sect. II. *Of Dykes.*

14[illegible] History of dykes.

We have described dykes (N° 15.) to be those interruptions of the strata which are formed by perpendicular fissures filled with stony substances. As these stony matters are frequently of that kind called whinstone, these dykes are commonly called *whin dykes*, and the history of these is very important, as they form one of the principal subjects in the principal theories of the earth.

14[illegible] Names.

Dykes have received different denominations descriptive, in some measure, of the nature of the substances of which they are composed; or of the seeming effects they have produced on the intersected horizontal strata. They are called *basaltic veins*, *trap dykes*, *whin dykes*; and in the coal countries of Scotland they are called *gaws*, from the idea that they have occasioned the separation of the coal, and contiguous strata, through which they run.

These dykes have been more attentively observed in coal countries, than where they occur elsewhere; because on the accurate knowledge of their course, inclination, and thickness, depend, in a great measure, the judicious and successful operations of the miner, when his workings approach the dyke, or render it necessary to cut through it to reach the strata of coal on the other side. But, though less attended to, they have been observed and traced in other places, where a great extent of the horizontal strata has been exposed in the beds of rivers, as in the bed of the Water of Leith, above St Bernard's Well, near Edinburgh, and on the sea shore, especially on the western coasts of Scotland, where the rocks are more abrupt and precipitous, and where the violence of the Atlantic ocean has removed part of the horizontal strata, and left the vertical strata remaining, like immense walls or dykes. Hence probably the origin of the name; and as they often consist of that species of stone called *whinstone*, this epithet has been added.

14[illegible] Course.

The course, however, of the greater number which we have had the opportunity of examining, generally lies between the points of the compass S. and S. E. and N. and N. W. This is most frequently the course of the whin dykes of Islay and Jura; it is the course of a remarkable dyke which traverses the coal strata at the village of Stevenson, near Saltcoats, in Ayrshire; part of which is seen on the surface, not many hundred yards to the north of the west end of that village;

lage; and it is the course of two dykes, still more remarkable, in the island of Great Cumbray, in the frith of Clyde.

Geologists, who have treated this subject, do not seem to have marked, with much attention, the course of the dykes. They have mentioned in general terms, that they follow all directions. More extensive observation may probably shew, that the most frequent directions of the principal dykes, is from north to south, or a few points deviation from that course. And if this be established, by a fuller and more accurate history of dykes, the analogy between them and metallic veins will be more complete; for it is observed of the latter, that the most powerful, that is, the most productive, run from north to south.

Dykes do not always run in a straight line. In their course they form certain flexuosities. But, in this winding course, the deviations are usually so small, as to have little effect on the general direction of the dyke, which, upon the whole, may be considered as nearly the same.

The continuity of dykes is sometimes interrupted, exactly in the same manner as frequently happens to the horizontal strata, and which, in technical language, is termed a *slip*.

In the island of Islay we have observed two dykes of this description, the one on the south side of Lochindal, near the point of Laggan; the other on the shore of the south-east part of the island, a little to the south of the house of Ardmore. In both these dykes, the extent of the separation of the slip was just equal to the thickness of the dyke. The opposite sides were brought exactly into the same line.

After this separation, these dykes, in so far as they could be traced, preserve the same thickness, course, and inclination as formerly.

A very remarkable dyke has been discovered, in the coal field, in the district of Boulogne in France. It runs in the form of a crescent from north to west.

5 …nation. The direction of dykes downwards is seldom perpendicular. This deviation from a line perpendicular to the horizon is called their inclination. The inclination of a dyke is usually denominated the *hade* or *hading*. See the article Coalery.

The inclination of different dykes, and even of the same dyke, is various, sometimes approaching to, and sometimes deviating from the perpendicular. The extent of dykes downwards, we believe, has not been ascertained with any degree of accuracy, and the termination of very few has yet been detected. The depth to which researches of this kind can be carried, is comparatively small. With all the ardour, ingenuity, and power of man, investigations to determine this point, will probably always be limited by the extent of his mining operations. The crescent-formed dyke just mentioned, which occurs in a coal-field in the district of Boulogne in France, which consists of a species of marble, found in several quarries in the vicinity, has been traced to the perpendicular depth of 600 feet, where it is succeeded by a schistus rock, which latter, with the same course and inclination, continues to intersect the horizontal strata.

1 …tent. The extent of dykes in length has not been accurately determined. Indeed, it must be extremely difficult to trace them with any degree of certainty. For those which are observed on the sea coast, where they are most conspicuous, soon disappear in the mountains, on the one hand, or on the other lose themselves in the sea. And, as the extent of the same coal field rarely exceeds a few miles, they have seldom been followed beyond its limits. In many cases, the change in the nature and arrangement of the strata, renders it almost impossible. Some, however, have been traced to a very great extent; one in particular, on the banks of the river Meuse in the Netherlands, has been followed in its direct course, to the distance of four leagues; and of this dyke it is observed, if pursued through all its windings, the extent is not less than six leagues.

The thickness of dykes is various. Sometimes they are observed no thicker than a few inches. From that they increase to one foot, six feet, and very often are found from 10 to 20 feet. There is one in the island of Islay, of the enormous thickness of 69 feet. This immense dyke accompanies a lead vein, about a foot thick, which is included between it and the limestone strata. In this mining field, two whin dykes, one of them 10 feet thick, have been discovered, crossing the metallic veins. 147 Thickness.

In going downwards, dykes are said to decrease in thickness. This is particularly observed of dykes of smaller magnitude. Of smaller dykes it is also said, that they diminish in thickness towards the extremities.

In one respect, some whin dykes are exactly analogous to metallic veins, in having branches, or in the miners phrase, *strings* going off and traversing the contiguous strata, and forming in the course they take, an acute angle with the principal dyke. A whin dyke of this description has been observed in the island of Jura, on the shore of the sound. The diverging branch terminated in a point among the horizontal strata, at the distance of a few feet from the great dyke, assuming altogether a wedge-like form.

If we include metallic veins in the account, the vertical strata may be said to be composed of every kind of mineral substance, but almost always different from the intersected horizontal strata. By this last circumstance their occurrence is at once recognized. In general, the dykes that are found in Scotland, whether in the coal countries, or in the western coasts and islands, where they are so frequent, are of that species of stone which comes under the denomination of trap or whinstone. Dykes, consisting of other species of stone, have also been found in Scotland. On the Mull of Kinouth, which forms the southern headland, at the entrance of Lochindal, in Islay, we observed a small dyke of granite, crossing the headland, which is of granular quartz. There are some vertical strata of granite in the island of Icolmkill, of pitchstone in the island of Arran, and of serpentine at Portsoy in Banffshire. 148 Materials.

Bergman, in his Physical Geography, supposes that granite was never found to be a component part of vertical strata. What has been already mentioned proves the contrary. Granite dykes have also been discovered in other places. Besson has observed dykes of this description on the great road between Limoges and Cahors in France, traversing horizontal strata of argillaceous schistus, a species of stone which has generally been considered of later formation than granite. These dykes, he observes, are from an inch to six

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six feet in thickness, and the quartz, feldspar, and mica, are of larger size than are usually found in the granite of mountains. Dolomieu has made a similar observation, and considers it as a discriminative character, by which the granite of mountains and that found in vertical strata may be easily distinguished. But this is not always to be admitted as a characteristic mark of distinction. The granite dyke which has been already mentioned, crossing the granular quartz, on the Mull of Kinouth in Islay, is small grained, and others of this latter description have been observed in other places.

There is a very singular dyke on the coast of Ayrshire, between Weems bay and Largs, near the house of Kelly. It is about ten feet thick, traverses the horizontal strata, which consist of plumb-pudding rock, whose cement is sandstone of a red colour, from north-east to south-west, and crosses a larger dyke of the whinstone of this country, nearly at right angles. This dyke is composed of different materials. Part is of the common whinstone, and part of a plumb-pudding rock, cemented by the matter of the dyke; and these alternate with each other, both in the thickness of the dyke, and lengthwise. On one side, there are four feet thick of whinstone; immediately in contact with this there is plumb-pudding stone three feet thick, and so on alternately, across the whole dyke. In tracing the dyke lengthwise across the whole line, there is found a few yards of whinstone, which is succeeded by a few yards of plumb-pudding stone, and this is again succeeded by the whinstone.

But, for the general view which is here proposed, it is not requisite to give a full account of all the mineral substances which enter into the composition of vertical strata, or even a minute enumeration of all the varieties that are found in whin dykes.

149 Peculiar structure of whin dykes.

One of the most singular circumstances respecting whin dykes, which seems to have been entirely overlooked by geologists, still remains to be considered. This is the peculiar structure or arrangement of the parts of which they are composed. Of this peculiar arrangement it may be observed in general, that it is in all respects the reverse of what takes place in the horizontal strata.

When the dyke is of small magnitude, it is pretty compact in all its parts; but if an attempt be made to break or separate any part of it, the fracture will be found to run most readily in the perpendicular direction. But when the dyke is of more considerable thickness, it usually forms several divisions, marked by perpendicular fissures, and there is often very great variety in the nature and qualities of the several divisions of the same dyke. The exterior division of one side sometimes, and sometimes the exterior division of both sides, are of a softer texture than the intermediate division; and often contain, in great proportion, specks of radiated zeolite and calcareous spar, while the middle divisions, as well as being harder, are also more homogeneous. In other cases, the reverse of this appears. The middle parts of the dyke are the softest and least compact, exhibiting the greatest variety of heterogeneous substances.

Some whin dykes have a great tendency to assume, when broken, the prismatic form. This is the case with many, even of the most compact texture. In others, where the side of the dyke is exposed to view, and minutely examined, fissures may be traced, discovering the ends of pretty regular prisms. But in some dykes in the island of Jura, the prismatic columns are entirely separated, and lying loose, are four, five, or six-sided, jointed; the perpendicular fissures forming the joints, and in all respects similar to the perpendicular basaltic columns, except being in the horizontal position. In one of the dykes in the island of Jura, the columns are from 12 to 18 inches in diameter. In some others on the sea shore, near the house of Mr Campbell of Jura, and at the harbour of the Small Isles, in the same island, there are columns of the enormous size of 10 and 12 feet diameter.

A dyke which traverses the basaltic strata of the Giants Causeway in the north of Ireland, exhibits still more remarkably this peculiarity of structure. The smallest masses detached from it assume the columnar form, and most of them are perfectly regular. The fracture invariably runs in the horizontal direction; the columns consequently lie in the same position, are three, four, five, and six-sided, and are generally of small size. *Observations on Vertical Strata, by* Dr Millar, *Scots Mag.* vol. lxiv.

Sect. III. *Of Metallic Veins.*

15[0] Metal[lic] veins.

The history of metallic veins, although far from being so full and satisfactory as could be wished, is more complete than that of whin dykes. The latter have excited no farther attention than as objects of curiosity to the geologist, or as singular facts in establishing a theory, and when they come in the way of the operations of the miner, to discover their connexion with the contiguous strata; while the wants and luxuries of man have roused ingenuity and exertion in exploring the former, on account of the precious and useful metals with which they are stored. Thus, the splendour and beauty of some metallic substances, and the utility of others, have made them in all ages be esteemed and valued by mankind; and consequently they have been the constant objects of pursuit and investigation. It is obvious that the beauty and utility of metals, on account of which they are so much valued and sought after, excite greater interest in procuring them; on the one hand, the researches and observations of the philosopher in furnishing the history and general principles, and, on the other, the immediate application of this knowledge, and of these principles, in the practice and operations of the miner.

The history of whin dykes is, in general, quite analogous to metallic veins; but, of the latter, from what has been stated, we can speak with more certainty and precision.

1[51] Distinction of veins.

Three different kinds of metallic veins have been described by geological writers; the *perpendicular* vein, the *pipe* vein, and the *flat* or *dilated* vein. We shall consider each of these in their order.

1[52] Perpendicular veins.

1. *Of the perpendicular vein.*—This kind of metallic vein occurs most frequently. As may be expected, it is various in its course or direction, thickness, and inclination. Metallic veins are found running in every direction; but, in general, the most powerful veins, that is, the most productive, are observed to run from north to south, or at least a few points deviation from that course; and when any deviation happens, it is usually to the east of north, and to the west of south.

1[53] Course of veins.

The course or direction of a vein is called in technical

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cal language its *bearing*. The extent of a vein in the line of bearing, we believe, rarely exceeds the range of mountains in which it is discovered. This is the case with the principal vein at Leadhills. It is limited to the chain of mountains in which the operations are now carried on; and although the mines of Wanlockhead are not a mile distant, new veins appear with galena or lead ore, of quite a different quality, and all the accompanying minerals, whether forming part of the vein, or found in cavities, are also quite different from the lead ore and other minerals found in the veins at Leadhills.

154 Inclination.

The inclination of veins is various. Sometimes they are nearly perpendicular; sometimes they deviate considerably from a perpendicular line; sometimes the same vein in its course downward, inclines to one side; sometimes it is perpendicular, and sometimes it inclines to the other side. When the deviation from the perpendicular does not exceed 10°, the vein is still considered as a perpendicular or vertical vein. When a vein is inclined, the two sides which include the metallic substances are in very different positions, and have consequently received from the miners different names. That side which supports the metallic ore, or on which it seems to lean, is called the *ledger side*, or simply the *ledger*. The opposite side which covers the ore, or which overhangs it, is denominated the *hanging side*, or simply the *hanger*. From the inclination of the vein being varied in its course downwards, it must appear that the same sides, according as the inclination varies, must change their position and denomination. This will perhaps be more intelligible by the section at fig. 5. in which AA represents the vein; BB, CC, DD, EE, the strata intersected by it; 1. the hanger; 2. the ledger; 3. the hanger; and, 4. the ledger.

155 Thickness.

The thickness of veins, and indeed of the same vein, is also extremely various. Sometimes they are only a few inches thick. From this they increase to the thickness of several feet. The veins which were wrought at Leadhills, about seven years ago, were from two to six feet within the sides; but some years before that time the principal vein in those mines, by the addition of two strings or small veins, assumed the extraordinary thickness of 14 feet of pure ore. This unusual appearance, both on account of its richness and grandeur, excited so much attention and admiration, that the countess of Hopetoun undertook a journey to these inferior regions, not less than 150 fathoms below the surface of the earth, to witness the splendour and brilliancy of this subterraneous apartment. The uncommon thickness and abundant richness of this vein are still talked of at Leadhills with enthusiasm. But a thicker vein was once wrought at Llangunog in Wales. Fifteen feet of clean ore were for some time dug out of this vein. These are, however, far exceeded by the copper veins in the Parys mountain in Anglesea, which are described by Mr Pennant in his Welsh tour. The thickness of one of these veins is 21 feet, and of another 66 feet.

The broadest metallic vein, of which we have any account, is, we believe, that of the Ecton copper mine, in Derbyshire. In this mine there was worked, at one time, a heap of ore, of the astonishing extent of 70 yards from side to side *.

The extent of veins downwards has in many cases been ascertained. To the regret and disappointment of the miner, they have been frequently intercepted and entirely cut off by the horizontal strata. The rich vein of lead ore at Llangunog in Wales, which we have already mentioned, was intercepted in this manner by a stratum of black schistus or shiver, the nature of which is not described by Williams, who states the fact *. Their researches to recover their lost wealth, which were prosecuted for several years, proved altogether fruitless. The smallest trace of this unusually productive vein was never afterwards discovered.

156 Two kinds of perpendicular veins.

Two kinds of perpendicular mineral veins have been observed and described. In the one case the relative position of the strata which contain the metallic substances is exactly similar to that of the coal strata when they are intersected by a whin dyke. On one side of the vein the strata are elevated or depressed from their former plane. This is illustrated by fig. 5. where the letters BB, CC, DD, EE, mark the corresponding strata which have been deranged or displaced. In the other kind of vein the mineral substances containing the metallic ores are merely separated without any elevation or depression; for each side of the fissure still remaining in its former plane, the opposite sides of the divided strata exactly correspond to each other. The mines at Strontian in Argyleshire are of this latter description.

Veins of this kind have frequently smaller veins, or, as they are called in the language of the miners, *strings*, which run off at an acute angle, preserve their course for some distance, not, in general, very great, gradually diminish in thickness, and at last are entirely lost among the contiguous strata. At the place of junction the principal vein is always thicker, as has been already noticed with regard to the unusual thickness of the principal vein at Leadhills.

To this account of perpendicular veins we may add, that some veins are found crossing each other, and that whin dykes have also been discovered intersecting metallic veins. Examples of the latter occur in the island of Islay.

157 Pipe vein.

2. *Of the pipe vein.*—The perpendicular vein last described, intersected or cut the strata across. What has been denominated the pipe vein is extremely limited in the line of bearing, but having the same inclination as the strata which include it. It may be considered as in some measure of a circular form, extremely irregular, and always following the course of the strata between which it is included, like the perpendicular veins; sometimes as it dips downwards, it is enlarged; sometimes it is diminished, and sometimes it is so much contracted, that the including strata come into close contact. In a word, this kind of vein is subject to all the irregularities of the veins formerly described, only that its inclination is invariably the same with the accompanying strata.

158 Flat vein.

3. *The flat or dilated vein.*—This kind of metallic vein, after what has been said with regard to other veins, will require but a short description. It is exactly similar to the pipe vein, only that it is more extended in the line of bearing. It is included between the horizontal strata; and therefore its inclination or dip must be the same as the including strata. A vein of this kind might with more propriety and accuracy be regarded as a metallic horizontal stratum, were it not that

* Pryce's Derbyshire p. 11.

* *Mineral Kingdom*, vol. i. p. 274.

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that it is always found varying in its dimensions, and equally irregular as the perpendicular veins which intersect the horizontal strata.

It is almost needless to add, that the flat or horizontal veins are subject to the same derangement as the coal strata, when they are intersected by a whin dyke. The vein, along with the including strata, is either elevated or depressed, and the same thing takes place when they are traversed by a metallic vein. MS. by Dr Millar.

159 Metallic ores. To finish the sketch of the history of metallic veins, we have only to enumerate the different metallic ores that occur in them, and to mention the places where these are found in greatest abundance. In this enumeration we shall follow the arrangement of metals given by Brochant, in the second volume of his *Traité Elementaire de Mineralogie*.

In naming the several species, we shall adopt the nomenclature of Kirwan, adding the French and German synonyms to each. As it would far exceed our limits to give even a *cursory description* of the several species, we refer the reader for that to the article MINERALOGY in this work, or to the elementary treatises of Kirwan or Brochant, or the more extensive treatise of Hauy.

I. PLATINA

160 Platina ores. Has been found hitherto only in its metallic or native state, and it has as yet only been met with in South America, especially at Choco in New Grenada. It is found in the sand of rivulets, and probably comes from the primitive mountains.

II. GOLD.

161 Gold ores. *Native gold.*—This is found principally in primitive mountains, sometimes in veins, and sometimes disseminated through the stony matter. The substances which most commonly accompany it are quartz, feldspar, calcareous spar, heavy spar, pyrites, red silver ore and vitreous silver ore, and galena. Gold is still more commonly met with in the sand washed from certain rivers. The countries where gold is chiefly found in rocky substances, are Hungary, Transylvania, Peru, Mexico, Siberia, and Sweden. It has also been found in France, near the town of Oisans, in the department of the Isere; but not in sufficient abundance to render the working of the mine profitable. Among the rivers whose sands furnish gold, we may enumerate the Rhine, the Danube, and the Araniosch in Transylvania.

Gold has been found in several parts of the British dominions, especially at Silsoe in Bedfordshire, in the Wicklow hills in Ireland, and in the neighbourhood of Leadhills in Lanarkshire. It is said that a jeweller, who died lately in Dublin, often declared that gold, to the value of 30,000l. had passed through his hands, which was brought from the Wicklow hills. This mine is now in the hands of government, but we believe does not answer the expectation that was first formed as to its produce. General Dirom informs us, that in the reign of James V. of Scotland, 300 men were employed for several summers in washing the sand near Leadhills for gold, of which they are said to have collected to the amount of 100,000l. sterling. It is said that pieces of gold, an ounce in weight, have been found at Leadhills, and that Lord Hopetoun has a piece still larger in his possession*.

* *Mawe's Derbyshire*, p. 139.

III. MERCURY.

162 Mercury ores. Species 1. *Native Mercury*, or *Quicksilver*. Le Mercure natif. Gediegen Quecksilber.—This is found at Idria in the Austrian territories; at Almaden in Spain; in the Palatinate, and a few other places. We are told by Mr Jameson, that a quantity of quicksilver was discovered some years ago in a peat moss, in the island of Islay, and he thinks it probable that veins of it exist there *; but there seems no ground whatever for such expectations.

* *Min. the Isles*, vol. i. p. 153.

Species 2. *Natural Amalgama*. L'Amalgame natif. Naturalicher Amalgam.—This consists of mercury and silver, in very variable proportions. It is found at Sahlberg in Sweden; at Roseneau in Hungary, and especially at Moschellandsberg in the duchy of Deux Ponts, where it is found mixed with common ferruginous clay, and with other ores of mercury.

Species 3. *Mercury Mineralised by the Sulphuric and Muriatic Acids*. Mercure Corneé *ou* Muriaté. Quecksilber Hornerz.—This species was discovered about 30 years ago, in the mines of Moschellandsberg, and at Morefeld, in the duchy of Deux Ponts, by M. Woulfe, mixed with ferruginous clay, quartz, lithomarga, native quicksilver, and cinnabar. It has also been found at Almaden in Spain, and at Hersowitz in Bohemia; but it is very rare.

Species 4. *Native Cinnabar*. Le Cinnabre. Zinnober.—This usually forms a gangart for the other ores of mercury. It occurs in the stratiformed mountains, pretty near the surface. This ore is found in a great many parts of Europe, especially at Almaden in Spain, Idria in the Austrian territories, at Moschellandsberg, in Bohemia, in Saxony, in Hungary, in Transylvania, in the Palatinate, and in France; but in this last it is found but in small quantity.

IV. SILVER.

Species 1. *Native Silver*.—A particular variety of this species, mixed with gold, is very rare. It is principally found in Conigsberg in Norway, and Schlangenberg in Siberia. In the former of these places it is found disseminated through calcareous spar, fluor spar, and rock crystal, in a vein running through a rock of hornblende slate, and accompanied with blende, galena, and pyrites. That of Siberia is found distributed through a mass of heavy spar. 163 Silver ores.

Common native silver is found in considerable quantity in Mexico and Peru. It is also met with in Siberia, Saxony, France, Sweden, Norway, in the Hartz, and in Bohemia. It is principally found in the primitive mountains, distributed through masses of heavy spar, quartz, calcareous spar, fluor spar, pyrites, blende, cobalt, galena, red silver ore, and vitreous silver ore.

Silver has been found in several parts of Britain, especially near Alva in Scotland. It is confidently affirmed, that a mass of capillary silver, weighing 16 oz. was found in the lead mines at Garthoness in the isle of Islay, mixed with galena †.

† *Min. Isles*, v. i. p. 153.

Species 2. *Antimoniated Native Silver*. L'Argent Antimonial. Spiesglas Silver.—This species has hitherto been only found in the mine at St Wenceslas at Altwolfach, and in the duchy of Wirtemberg, in a vein mixed with calcareous spar, heavy spar, native silver, and quartz.

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Species 3. *Arseniated Native Silver.* L'Argent Arsenical. Arsenik Silber.—This is also rare, having been found only at Andreasberg, in the Hartz, and at Kassala in Spain. In the Hartz it is mixed with native arsenic, red silver ore, galena, blende, and calcareous spar. Considerable quantities of silver, probably of this species of ore, are obtained from the lead ore of Leadhills.

Species 4. *Corneous Silver Ore*, or *Muriated Silver.* L'Argent Cornée *ou* Muriaté. Horn Erz.—This has been found in Peru, Mexico, Saxony, France, Siberia, and, as is affirmed, in Cornwall in England.

Species 5. *Sooty Silver Ore.* L'Argent Noir. Silberschwarze.—This is found in Saxony, France, and Hungary, mixed with other ores of silver, and sometimes with native silver.

Species 6. *Vitreous Silver Ore.* L'Argent Vitreux. Silberglaserz.—This is found in Bohemia, Saxony, Norway, Swabia, Siberia, and in Hungary, mixed with other silver ores, and usually accompanying calcareous spar, heavy spar, and fluor spar.

Species 7. *Red Silver Ore.* L'Argent Rouge. Rothgiltegerz.—This is found in the Hartz, Bohemia, Saxony, France, Swabia, and in Hungary, accompanying native arsenic, realgar, vitreous silver ore, galena, calcareous spar, and heavy spar.

V. Copper.

164 Copper ores. Species 1. *Native Copper.*—This is met with in Siberia, the Uralian and Altaischan mountains, Kamtschatka, Japan, Saxony, France, Sweden, Hungary, Palatinate, and near Redruth in Cornwall, in England. It usually accompanies other ores of copper, especially malachite and copper azure.

Species 2. *Vitreous Copper Ore.* Le Cuivre Vitreux. Kupferglas.—This is found in Siberia, Hungary, Sweden, Norway, Russia, Saxony, Silesia, Hesse, and in Cornwall.

Species 3. *Purple Copper Ore.* La Mine de Cuivre Violette. Buntkupfererz.—This is always found in the neighbourhood of other copper ores, especially with the species last mentioned, and with copper pyrites. It is found in Saxony, Bohemia, the Bannat in Transylvania, the Hartz, Norway, Russia, Sweden, Hungary, Hesse, and in Derbyshire in England, especially in the famous Ecton copper mine.

Species 4. *Yellow Pyrites*, or *Yellow Copper Ore.* La Pyrite Cuivreuse. Kupferkies.—This is the most common species of copper ore, and is found both in primitive and secondary mountains, sometimes in beds, and sometimes in veins. It occurs most abundantly in Bohemia, Saxony, Hungary, Sweden, France, Spain, and especially in Britain, where it forms one of the principal varieties of copper ores, found in the famous Parys mine in the isle of Anglesea.

Species 5. *White Copper Ore.* La Mine de Cuivre Blanche. Weisskupfererz.—This species is very rare, but it has been found in Saxony in the mines of Freyberg, in Hesse, in Wirtemberg, and in Siberia, with other copper ores.

Species 6. *Gray Copper Ore.* Le Cuivre Gris. Fahlerz.—This again is a very common species, and is found in all those countries that possess mines of copper.

Species 7. *Black Copper Ore.* Le Cuivre Noir. Kupferschwarze.—This is found mixed with malachite and with green and blue copper ores in Saxony, Hungary, in the Bannat, in Silesia, in Norway, in Russia, in Swabia, in Sweden, and in Siberia. It also occurs in the Parys mine of Anglesea.

Species 8. *Florid Red Copper Ore.* Mine de Cuivre Rouge. Roth-kupfererz.—This usually accompanies native copper, malachite, and brown earthy iron ore. It is met with in Saxony, in the Bannat, in the Hartz, in Norway, in Siberia, near Cologne, and in Cornwall.

Species 9. *Brick-red Copper Ore.* Le Mine de Cuivre couleur de Brique. Ziegelerz.—Found in similar situations with the preceding.

Species 10. *Blue Calciform Copper Ore.* L'Azur de Cuivre. Kupferlazur.—Found in the Bannat, in Hesse, in Saltzburg, in Poland, in Siberia, in Thuringia, and in the Tyrolese. It is usually imbedded in slaty marl, or in sandstone, not far below the surface of the earth.

Species 11. *Malachite.*—This is always found mixed with other copper ores, and occurs in most of the copper mines that have been enumerated.

Species 12. *Mountain Green.* Le Vert de Cuivre. Kupfergrün.—This commonly accompanies species 4, 6, 9, 10, and 11. It is found in Saxony, in the Hartz, in Norway, Silesia, Siberia, Hungary, Wirtemberg, and Britain, as at Leadhills and in Derbyshire.

Species 13. *Olive Copper Ore.* Mine de couleur Olive. Olivenerz.—This species is extremely rare. It has been found chiefly near Karrarach in Cornwall, where it is accompanied by species 11 and 12, and brown iron ore in a gangart of yellow lithomarga mixed with quartz. It is said to have been found also at Jonsbach near Rustelstadt in Silesia.

VI. Iron.

Species 1. *Native Iron.*—This species is very uncommon; but it has been met with in several places, especially at Kamsdorf and Eibenstock in Saxony, at Kransnajarsk near Jenisei in Siberia, at Olumba near St Jago in South America, and Oulle near Grenoble in France. The two most remarkable specimens of native iron are those found in South America and in Siberia. The former of these forms a mass weighing at least 300 quintals, or 15 tons. It is soft and malleable, and in every respect like the purest iron. That of Siberia is a spheroidal mass, weighing about 14 quintals, resting on the surface of the earth, near the summit of a mountain. Its texture is cellular, and its cavities are filled with a transparent, greenish, vitreous matter. No mines or veins of iron are in the neighbourhood of either. 165 Iron ores.

Species 2. *Martial Pyrites.* Pyrite Martiale. Schwefelkies.—This species is one of the most common ores of iron, and is found abundantly in every country where there are any other ores of iron. There are three varieties of it described by Brochant, which are less common, but these are also found in many places.

Species 3. *Magnetic Pyrites.* La Pyrite Magnetique. Magnetkies.—This has been found only in primitive rocks, especially in micaceous schistus, accompanied by quartz, hornblende, &c. and usually lying in beds mixed with other pyrites, galena, and magnetic ironstone.

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stone. It is found in Saxony, Bavaria, Norway, and Silesia.

Species 4. *Magnetic Ironstone.* Le Fer Magnetique. Magnetischer Eisenstein.—Of this there are three varieties, the common magnetic ore, which is very common in primitive mountains, especially those that are composed of gneiss and micaceous schistus. It is often in great abundance, forming large beds, or even whole mountains. It is found in greatest quantity in Saxony, Bohemia, Italy, Corsica, Silesia, Siberia, Norway, and especially in Sweden. The second variety, called fibrous magnetic ironstone, is uncommon, but is found at Bibsburg in Sweden. The third, which Kirwan calls *magnetic sand*, is found in the banks of some rivers, particularly of the Elbe, as also in Sweden and Italy.

Species 5. *Specular Iron-ore.* Le Fer Speculaire. Eisenglanz.—This is found in many places, often in considerable quantity, especially in Saxony, Bohemia, France, Normandy, Prussia, Sweden, Siberia, Hungary, Corsica, and the island of Elba. It is generally found only in primitive mountains, sometimes in beds, sometimes in veins, accompanied with quartz, hornstone, martial pyrites, and magnetic iron ore.

Species 6. *Red scaly Iron Ore.* La Mine de Fer Rouge. Roth-Eisenstein.—This is rather rare, but is found in several parts of Saxony, in the Hartz, in Nassau, in Thuringia and Hungary. Another variety of the same species, the compact red ironstone of Kirwan, is much more common, being found in Saxony, Bohemia, the Hartz, Hesse, Siberia, and in France, sometimes in veins, and sometimes in beds, commonly mixed with the two following species, and with argillaceous ironstone, quartz, hornstone, and calcareous spar.

A third variety, the common hematites or bloodstone, which is one of the most productive iron ores, is always found accompanying the last variety, and is of course met with in most of the situations above enumerated. It is produced in abundance in several parts of England, as in Derbyshire, but more especially at Ulverston in Lancashire, where there is one perpendicular vein of it 30 yards wide, in a rock of limestone. Large quantities of it are carried to Carron, where it is smelted with the common Carron ironstone.

Species 7. *Brown Iron Ore.* La Mine de Fer Brune. Braun-eisenstein.—Of this there are several varieties, of which the compact brown ironstone, and the brown hæmatites, are very common; but the brown scaly iron ore is rather rare. The last is found at Kampsdorf in Saxony, at Klausthel, in the Hartz, at Lauterick in the Palatinate, and at Naila in the principality of Bareith.

Species 8. *Calcareous Iron Ore.* La Fer Spathique. Spathiger-eisenstein.—This is found both in primary and secondary mountains, and there are few veins of iron which do not contain it in greater or less quantity.

Species 9. *Black Ironstone.* La Mine de Fer Noire. Schwarz-eisenstein.—This is found in the principality of Bareith, in the Hartz, Saxony, Hesse, and Palatinate.

The common argillaceous iron ore of Kirwan, is ranked by Brochant as a variety of this. It is very common in most iron countries, and much of it is found in Britain, especially in Colebrook-dale, Shropshire, and in Dean forest in Gloucestershire. The Carron ore is principally of this kind.

Species 10. *Lowland Iron Ore.* La Mine de Fer de Gazon. Reasen-eisenstein.—There are several varieties of this, all of which are found in low, humid situations, in very extensive beds, alternating with sandstone, clay, &c. This species is much more abundant in the north than in the south of Europe, especially in the duchy of Brandenburg, in Courland, Lithuania, Livonia, Prussia, Prussian Poland, and Lusace.

Species 11. *Blue Martial Earth.* La Fer Terreux bleu. Blaue-eisenerde.—This is found imbedded in clay and similar earths, and often accompanies the last species. It occurs in Saxony, Silesia, Swabia, Bavaria, Poland, and the Palatinate.

Species 12. *Green Martial Earth.* Le Fer Terreux Vert. Grun-eisenerde.—This species is uncommon, having been found only at Braunsdorf, and Schneeburg in Saxony, in veins, accompanying quartz and sulphur pyrites.

Species 13. *Emery.* L'Emeril. Schmirgel.—This is found in Saxony, distributed in a bed of hardened steatites, in sandstone. It is also found in Italy, Spain, Peru, the isle of Naxos in the Archipelago, where there is a cape called by the Italians, *Capo Smeriglio*, or the *Emery Cape*. It is often mixed with particles of magnetic iron ore, whence some have supposed the emery to be magnetic.

VII. Lead.

166 Lead.

Species 1. La Galéne Commune. Gemeiner-Bleiglanz.—This is the most common and abundant ore of lead, and is found both in primitive and secondary strata, in beds and veins, accompanied with quartz, fluor spar, calcareous spar, sparry iron ore, barytic earths, blende, pyrites, and several ores of silver. It is found in great abundance at Leadhills and at Wanlockhead in Dumfrieshire, in Derbyshire, Strontian in Scotland, and in the Mendip hills in Somersetshire. A variety of this, called compact galena, is found in the same situations, especially in Derbyshire. It has often been confounded with *graphite*, or *plumbago*.

Werner enumerates nearly 20 formations, as he calls them, of galena, but Mr Jameson thinks the galena formation in Dumfriesshire is different from any of these.

Species 2. *Blue Lead Ore.* La Mine de Plomb Bleue. Blau-bleierz.—This species has as yet been found only at Zschopau in Saxony, accompanying fluor spar, barytic spar, white and black lead, and malachite.

Species 3. *Brown Lead Ore.* La Mine de Plomb Brune. Braun-bleierz.—This species is also very rare, but is found at the same place with the last, and also in Bohemia, Brittany, and Hungary.

Species 4. *Black Lead Ore.* La Mine de Plomb Noire. Schwarz bleierz.—This is found in Saxony, at Freyberg, at Zschoppau, in Cumberland, in some parts of Scotland, in Poland, and Siberia.

Species 5. *White Lead Ore.* La Mine de Plomb Blanche. Weiss-bleierz.—This is not a very abundant species, but it is found in several lead mines, especially in Bohemia, Saxony, the Hartz, France, Siberia, Hungary, Carinthia, and in some of the British lead mines, especially at Leadhills.

Species 6. *Green Lead Ore.* Phosphorated lead ore of Kirwan. La Mine de Plomb Vert. Grun-bleierz.—This is found in veins, more commonly in the primitive mountains. It is met with in Bohemia, Saxony,

Bavaria,

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Bavaria, Siberia, Brisgau, France, Peru, and at Leadhills in Scotland.

Species 7. *Red Lead Spar.* Le Plomb Rouge. Rothes-bleierz.—This is one of the rarest ores of lead, being as yet only found at Ekatharenburg in Siberia.

Species 8. *Yellow Lead Spar.* Le Plomb jaune. Gelbes-bleierz..—This has been known only for a few years. It has been found at Bleiberg in Carinthia, in a gangart of calcareous stone. It has also been found near Freyberg in Saxony, at Annaberg in Austria, and at Reczbanya in Hungary.

Species 9. *Native Vitriol of Lead.* Le Vitriol de Plomb natif. Naturliher-blei-vitriol.—This is found in the isle of Anglesea, in a vein of brown iron ore, mixed with copper pyrites. It is also found at Leadhills in Scotland.

Species 10. *Earthy Lead Ore.*—Of this there are two varieties, the friable and the indurated. The former is found in Saxony, in Lorraine, in Poland, and Siberia, Bohemia, and Silesia. The latter is found in most lead mines. Mr Jameson notices two varieties of lead earth, which he calls white-lead earth, and friable lead earth, as met with at Leadhills.

VIII. Tin.

Tin ores.

Species 1. *Tin Pyrites.* La Pyrite d'Etain. Zinnkies. This species is very rare, and is, we believe, found only in Cornwall, at Wheal rock, among *copper pyrites.*

Species 2. *Common Tinstone.* La Pierre d'Etain. Zinnstein.—This is found chiefly in primitive rocks, as in granite, gneiss, micaceous schistus, and porphyry, both in masses and veins. It is the common ore of Cornwall, and is found also in Saxony, Bohemia, and the East Indies.

Species 3. *Wood Tin Ore.* L'Etain grenu. Zinnerz.—This is found in Cornwall, in the parishes of Colomb, St Denis and Roach, accompanying the former.

IX. Bismuth.

Bismuth ores.

Species 1. *Native Bismuth.*—Bismuth is a very rare metal, but is most commonly found in its native state. It is usually in a gangart of quartz, calcareous spar, and barytic spar. It occurs in Bohemia, in Saxony, in the territory of Hainault, in Suabia, in Sweden, and in France, in the mines of Brittany.

Species 2. *Sulphurated Bismuth.* La Galéne de Bismuth. Wismuth Glanz.—This is very rare. It commonly accompanies the former, and is found at Joachimsthal, in Bohemia, at Johann-Georgen-stadt, Schwarzenberg, and Altenberg in Saxony, and at Ridderhyttan in Sweden.

Species 3. *Bismuth Ochre.* L'Ochre de Bismuth. Wismuth Okker.—This is still more rare than the last, and is chiefly found near Schneeberg in Saxony, and at Joachimsthal in Bohemia.

X. Zinc.

Zinc ores.

Species 1. *Blende.* This is sulphurated zinc, and is one of the most common ores of that metal. There are three varieties; the brown, the yellow, and the black. Of these the yellow is the most rare, and is found in Saxony, in Bohemia, in the Hartz, in Norway. Transylvania, and Hungary. The brown and the black are found in most of these places, and besides in France and England, especially in Derbyshire.

Species 2. *Calamine.* La Calamine. Galmel.—Of this there are two varieties, *compact* and *striated.* Both occur only in particular stratiform rocks, often forming entire beds with indurated clay, and calcareous spar. The latter is usually found in the cavities of the former. Both occur in Bohemia, in Carinthia, and in most of the German lead mines. They are also found in Britain, especially at Leadhills, Wanlock-head, and in Derbyshire.

XI. Antimony.

170 Antimony ores.

Species 1. *Native Antimony.*—This is very rare. It was discovered at Sahlberg in Sweden, in the year 1748, in a gangart of some calcareous stone, and it was also found some years ago at Allemont in France, accompanying other ores of antimony and of cobalt.

Species 2. *Sulphurated Antimony.* L'Antimoine Gris. Grau-spies glas-erz.—There are several varieties of this, as the compact sulphurated antimony, found at Braunsdorf in Saxony; at Goldgronach in the principality of Bareith; at Maguria in Hungary, and Auvergne in France: foliated sulphurated antimony, found in Braunsdorf and Goldgronach, and in the Hartz, and Transylvania: striated sulphurated antimony, found in Saxony, Hungary, France, Swabia, Tuscany, Sweden, the Hartz, Spain, and in England: plumose antimonial ore, found at Freyberg in Saxony, at Braunsdorf and Stahlberg, and at Chemnitz in Hungary. All these varieties are usually found in a quartzose rock.

Species 3. *Red Antimonial Ore.* L'Antimoine Rouge. Roth-speis glas-erz.—This is found at Braunsdorf, at Malaska and Kremnitz, in Hungary, and at Allemont in France. It usually accompanies the first and second species, especially at Allemont, or the next species, which is the case at Braunsdorf.

Species 4. *Muriated Antimony.* Antimoine blanc. Weies-speis glas-erz.—White antimony is extremely rare; it is principally found at Przibran in Bohemia, in quadrangular, shining tables, disposed in bundles upon galena. It is said also to have been found at Braunsdorf and Malaska.

Species 5. *Antimonial Ochre.* L'Ocre d'Antimoine. Spies glas-okker.—This species is also very rare; it is found at Braunsdorf, near Freyberg, and in Hungary, always accompanying the second and third species.

XII. Cobalt.

Species 1. *White Cobalt Ore.* Le Cobalt blanc. Weisser speis-kobalt.—This is found in Norway, Sweden, at Anaberg in Saxony, in Swabia and Stiria; but it is very rare. In Saxony and Norway, it occurs in beds of micaceous schistus, along with the 7th species, and with quartz, hornblende, and pyrites. 171 Cobalt ores.

Species 2. *Dull Gray Cobalt Ore.* Le Cobalt gris. Grauer-speis-kobolt.—This is found in Saxony, Bohemia, France, Norway, Swabia, Hungary, Stiria, and in a few mines in England. It is sometimes mixed with ores of silver.

Species 3. *Bright White Cobalt Ore.* Le Cobalt Eclatant. Glanz-kobolt.—This is the most common of all the ores of cobalt, and almost always accompanies the ores of nickel, and of silver. It is found in Bohemia,

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hemia, Saxony, Silesia, the Hartz, Hesse, Sweden, Swabia, Norway, Stiria, Spain, Thuringia, and in England. It is found in beds in the primitive rocks, and in veins in the secondary.

Species 4. *Black Cobalt Ochre.* Le Cobalt Terreux noir. Schwarzer-erd-kobolt.—This is found in Saxony, in Thuringia, Swabia, Hesse, the Palatinate, Saltzburg, and in the Tyrol, accompanying other ores of cobalt, and several ores of silver, copper, and iron.

Species 5. *Brown Cobalt Ochre.* Le Cobalt Terreux brun. Brauner-erd-kobolt.—This is found in considerable quantity at Saalfeld in Thuringia; at Kamsdorf in Saxony, and at Alperspach in Wirtemberg, accompanying other ores of cobalt.

Species 6. *Yellow Cobalt Ochre.* Le Cobalt Terreux jaunne. Geber-erd-kobolt.—This is one of the rarest ores of cobalt. It is found at Saalfeld in Thuringia, at Alperspach in Wirtemberg, and at Altemont in Dauphiné in France.

Species 7. *Red Cobalt Ore.* Le Cobalt Terreux rouge. Rother-erd-kobolt. This is found in Saxony, Thuringia, Hesse, Swabia, Bohemia, Allemont in France, and in Norway.

XIII. Nickel.

172 Nickel ores.

Species 1. *Sulphurated Nickel.* Le Kupfer Nikel. Kupfer Nikkel.—This is found in veins, both in primitive and secondary mountains, almost always accompanying some of the ores of cobalt, to which it seems to bear some geological relation. It is also found in some silver mines. It is met with in Bohemia, Saxony, Thuringia, the Hartz, in Swabia, Hesse, Allemont in France, Stiria, and in some parts of Britain. Its usual gangart is quartz, barytic and calcareous spar.

Species 2. *Nickel Ochre.* L'Ocre de Nikel. Nikkel-okker.—This is found in the same situations with the last, from a decomposition of which it appears to be produced.

XIV. Manganese.

173 Manganese ores.

Species 1. *Gray Ore of Manganese.* Le Manganese. Grau-braunstein-erz.—There are several varieties of this, but they are all commonly found near each other, in veins or in masses, commonly in the primitive mountains.

They are found in considerable quantity in many mines in Saxony, Bohemia, Bavaria, and Hungary. They are also met with in France, and in several parts in Britain, as in Derbyshire, Leadhills, and Wanlockhead; in the Mendip hills, and the isle of Jura.

Species 2. *Red Manganese Ore.* Le Manganese rouge. Roth-Cronstein-erz.—This is very rare, but is found at Catnick, Offenbanya, and especially at Nagyag in Transylvania, at which last place it is found in a gold mine.

XV. Molybdena.

174 Molybdena ores.

Le Molybdene sulphure. Wasserbley.—This is found in Bohemia; at several places in Saxony; in Sweden; at Tillot in France, and at Chamouni at the foot of Mont Blanc. It is commonly found in primitive rocks, especially in tin mines.

XVI. Arsenic.

175 Arsenic ores.

Species 1. *Native Arsenic.*—This is found in Bohemia, Saxony, the Hartz, Carinthia, Swabia, Transylvania, and in France. It is always met with in veins, in primitive mountains, accompanied by realgar, galena, the ores of cobalt and nickel, and several ores of silver.

Species 2. *Arsenical Pyrites*, or *Marcasite.* La Pyrite Arsenicale. Arsenik-kies.—This is found in Bohemia, Saxony, and Silesia, accompanying the common tin stone, and galena, with some other minerals.

Species 3. *Realgar.* Le Realgar. Rauschgelb.—This is found in the Bannat, Bohemia, Saxony, Swabia, the Hartz, the Tyrol, Hungary, and in the neighbourhood of volcanoes, especially Ætna and Vesuvius.

Orpiment, which Brochant makes a variety of realgar, is found in several of the above places, and also in Natolia, in Servia, Transylvania, and Wallachia, usually accompanying quartz and clay.

Species 4. *Native calx of Arsenic.* L'Arsenic oxidé natif. Naturlechur arsenik-kalk.—This is very rare, but is found in a small quantity in Bohemia and Joachimsthal, in Saxony, at Raschau, at Salatna, in Transylvania, and in Hungary.

XVII. Tungsten.

Species 1. *Tungsten.* Le Tungstène. Schiverstein.—This is a very rare mineral, but is found at Schlackenwald in Bohemia, at Ehrenfriederdorf in Saxony, and at Riddarkytten, Bisburg in Sweden, usually accompanying quartz, mica, talc, and tin ore. Tungsten ores.

Species 2. *Wolfram.*—This is also pretty rare, but is found in Bohemia, Saxony, and at Poldice in Cornwall.

XVIII. Uranium.

Species 1. *Sulphurated Uranite.* L'Urane noir. Pecherz.—This is found at Joachimsthal in Bohemia, and at Johann-Georgen-Stadt, and Schneiberg in Saxony, accompanying the two following species, and lead and copper ores. Uranium ores.

Species 2. *Micaceous Uranitic Ore.* L'Urane Micacé. Uran-glimmer.—This is found in the Bannat, Saxony, Wirtemberg; near Autun in France, and near Karrarach in Cornwall.

Species 3. *Uranitic Ochre.* L'Ocre d'Urane Uranokher.—This has been found at Joachimsthal in Bohemia, and at Johann-Georgen-Stadt in Saxony, but it is uncommon.

XIX. Titanium.

Species 1. *Menakanite.*—This has been found chiefly near Menakan in Cornwall. Titanium ores.

Species 2. *Titanite.* Le Ruthile. Ruthil.—This is found at Boinik and Rhonitz in Hungary; in New Castile in Spain; at Aschaffenbourg in Franconia; at St Yreiux in France, and in Mount St Gothard, and some other places in the Alps.

Species 3. *Titanitic Siliceous Ore.* Le Nigrine. Nigrin.—This has been found near St Gothard in the Alps, at Ohlapian in Transylvania, &c.

XX. Tellurium.

Species 1. Sylvanite. Le Sylvane natif. Gediegen Sylvan.—This is found chiefly at Fatzeborg in Transylvania, but is now become extremely rare. It occurs in Tellurium ores.

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in beds of gray wacke and secondary (or transition) limestone.

Species 2. ———Le Sylvane graphique. Shrifterz. —This is found at Offenbanya in Transylvania, in a bed of porphyritic syenite, and granular limestone.

Species 3. ——— Le Sylvane blanc. Weiss-Sylvanerz.—This was brought to Brochant from Freyberg in Saxony.

Chap. III. *Of the most Remarkable Theories of the Earth.*

A late writer considers the proper object of a theory of the earth, to be the tracing the series of those revolutions which have taken place on the surface of the earth; to explain their causes, and thus to connect together all the indications of change that are found in the mineral kingdom. He justly observes, that the formation of such a theory requires an accurate and extensive examination of the phenomena of geology, and that it is inconsistent with any, but a very advanced state of the physical sciences. There is perhaps no research in those sciences more arduous than this; none where the subject is so complex, where the appearances are so diversified, or so widely scattered; and where the causes that have operated are so remote from the sphere of ordinary observation *.

With such requisites, and under such difficulties, it is not surprising that so many who have aimed at constructing theories of the earth, have failed in the attempt. It certainly requires a prodigious accumulation of facts, together with a talent for observation, and for arrangement, which are seldom found united. We shall presently see how far those theories which have hitherto been framed to account for the changes that the earth has undergone, have been successful.

It is not, however, to be supposed, that a correct theory of the earth is impossible, though some may think it an arrogant, if not a presumptuous undertaking, to attempt explaining how the present state of the globe and the revolutions which it has undergone, were brought about. The time is perhaps not far distant when the present prevailing hypothesis will be improved into a rational, and so far as is consistent with the knowledge and acquirements of man, a perfect system.

Mr Kirwan has laid down certain laws of reasoning; which should be adhered to inviolably in investigations of this kind. The first is, that no effect should be attributed to a cause whose known properties are inadequate to its production. The second is, that no cause should be adduced, whose existence is not proved either by actual experience or approved testimony. Many natural phenomena have arisen or do arise, in times or places so distant, that well conditioned testimony concerning them cannot, without manifest absurdity, be rejected. Thus the inhabitants of the northern parts of Europe, who have never felt earthquakes, nor seen volcanoes, must nevertheless admit, from mere testimony, that the first have been, and that the second do actually exist. The third is, that no powers should be ascribed to an alleged cause, but those that it is known by actual observation to possess in appropriated circumstances.

Sect. I. *Theory of Burnet.*

181 Theory of Burnet.

The first who formed this amusement of earth-making into a system, was the celebrated Thomas Burnet; a man of polite learning, and rapid imagination. His *sacred theory*, as he calls it, describing the changes which the earth has undergone, or shall hereafter undergo, is well known for the warmth with which it is imagined, and the weakness with which it is reasoned; for the elegance of its style, and the meanness of its philosophy. The earth, says he, before the deluge, was very differently formed from what it is at present: it was at first a fluid mass; a chaos composed of various substances, differing both in density and figure; those which were heaviest sunk to the centre, and formed in the middle of our globe a hard solid body; those of a lighter nature remained next; and the waters, which were lighter still, swam upon its surface, and covered the earth on every side. The air, and all those fluids which were lighter than water, floated upon this also, and in the same manner encompassed the globe; so that between the surrounding body of waters, and the circumambient air, there was formed a coat of oil, and other unctuous substances, lighter than water. However, as the air was still extremely impure, and must have carried up with it many of those earthy particles with which it once was intimately blended, it soon began to defecate, and to depose these particles upon the oily surface already mentioned, which soon uniting, the earth and oil formed that crust which soon became an habitable surface, giving life to vegetation, and dwelling to animals.

This imaginary antediluvian abode was very different from what we see at present. The earth was light and rich, and formed of a substance entirely adapted to the feeble state of incipient vegetation; it was a uniform plain, everywhere covered with verdure, without mountains, without seas, or the smallest inequalities. It had no difference of seasons, for its equator was in the plane of the ecliptic, or, in other words, it turned directly opposite to the sun, so that it enjoyed one perpetual and luxuriant spring. However, this delightful face of nature did not long continue in the same state, for, after a time, it began to crack and open in fissures; a circumstance which always succeeds when the sun exhales the moisture from rich or marshy situations. The crimes of mankind had been for some time preparing to draw down the wrath of heaven; and they at length induced the deity to defer repairing those breaches in nature. Thus the chasms of the earth every day became wider, and, at length, they penetrated to the great abyss of waters, and the whole earth in a manner fell in. Then ensued a total disorder in the uniform beauty of the first creation, the terrene surface being broken down; as it sunk, the waters gushed out in its place; the deluge became universal; all mankind, except eight persons, were destroyed, and their posterity condemned to toil upon the ruins of desolated nature.

It remains to mention the manner in which he relieves the earth from this universal wreck, which would seem to be as difficult as even its first formation. These great masses of earth falling into the abyss, drew down with them vast quantities of air; and by dashing against each other, and breaking into small parts by

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by the violence of the shock, they at length left between them large cavities filled with nothing but air. These cavities naturally offered a bed to receive the influent waters; and in proportion as they filled, the face of the earth became once more visible. The higher parts of its broken surface, now become the tops of mountains, were the first that appeared; the plains soon after came forward, and at length the whole globe was delivered from the waters, except the places in the lowest situations; so that the ocean and the seas are still a part of the ancient abyss that have not had a place to return to. Islands and rocks are fragments of the earth's former crust; kingdoms and continents are larger masses of its broken substance; and all the inequalities that are to be found on the surface of the present earth, are owing to the accidental confusion into which both earth and waters were then thrown.

Sect. II. *Theory of Woodward.*

182 Theory of Woodward.

The next who attempted a theory of the earth was Mr Woodward, who in his essay towards a natural history of the earth, endeavoured to give what he considered as a more rational account of its appearances than had been given by any preceding writer. He was indeed much better qualified for such an undertaking than any of his predecessors, as he was one of the most industrious naturalists of his time. Hence though his system must be considered as weak and untenable, his work contains many important facts relating to natural history.

Woodward sets out by asserting that all terrestrial substances are disposed in beds of various natures, lying horizontally, one over the other, like the coats of an onion, and that they are replete with shells and other marine productions; these shells being found in the deepest cavities, and on the tops of the highest mountains. From these observations, which were warranted by the experience of naturalists at that time, but which we now know not to be universally correct, he proceeds to remark that these shells and extraneous fossils are not productions of the earth, but are all actual remains of those animals which they are known to resemble; that all the beds of the earth lie below each other in the order of their specific gravities, and that they are disposed as if they had been left in this situation by subsiding waters. All this is affirmed with much earnestness, although many of the circumstances are contradicted by daily experience. Thus, we not unfrequently meet with layers of stone above the lightest soils, and find the softest earth below a stratum of hard stone. Woodward, however, having taken for granted, that all the strata of the earth are arranged in the order of their specific gravities, the lightest at the top, and the heaviest near the centre, he deduces as a natural consequence, that all the substances of which the earth is composed were once in an actual state of solution. This universal solution he conceives to have happened at the time of the flood. He supposes that at that time a body of water, which was then in the centre of the earth, uniting with that which was found on the surface, so far separated the terrene parts as to mix all together in one fluid mass; the contents of which afterwards sinking according to their respective gravities, produced the present appearances of the earth. Being aware, however, that an objection that fossil substances are not found dissolved, he exempts them from this universal dissolution, and for that purpose, endeavours to show that the parts of animals have a stronger cohesion than those of minerals; and that, while even the hardest rocks may be dissolved, bones and shells may still continue entire.

Sect. III. *Theory of Whiston.*

183 Theory of Whiston.

Of all the theories of the earth that have been formed, previous to those of Hutton and Werner, none has been more applauded or more opposed than that of Whiston. Nor is this surprising; for this theory being supported with all the parade of mathematical calculation, confounded the ignorant, and produced the approbation of such as desired to be thought learned, since it implied a considerable knowledge of abstract science, even to be capable of comprehending what the writer aimed at. It is not easy to divest this theory of its mathematical garb, but the result of our philosopher's reasoning appears to be as follows.

He supposes the earth to have been originally a comet, and he considers the history of the creation, as given us in scripture, to have its commencement just when it was, by the hand of the Creator, more regularly placed as a planet in our solar system. Before that time, he supposes it to have been a globe without beauty or proportion; a world in disorder, subject to all the vicissitudes which comets endure; some of which have been found, at different times, a thousand times hotter than melted iron; at others, a thousand times colder than ice. These alternations of heat and cold, continually melting and freezing the surface of the earth, he supposes to have produced, to a certain depth, a chaos entirely resembling that described by the poets, surrounding the solid contents of the earth, which still continued unchanged in the midst, making a great burning globe of more than two thousand leagues in diameter. This surrounding chaos, however, was far from being solid: he compares it to a dense though fluid atmosphere, composed of substances mingled, agitated, and shocked against each other; and in this disorder he describes the earth to have been just at the eve of creation.

But upon its orbit being then changed, when it was more regularly wheeled round the sun, every thing took its proper place, every part of the surrounding fluid then fell into a situation, in proportion as it was light or heavy. The middle or central part, which always remained unchanged, still continued so, retaining a part of that heat which it received, in its primeval approaches towards the sun; which heat he calculates, may continue for about six thousand years. Next to this fell the heavier parts of the chaotic atmosphere, which serve to sustain the lighter; but as in descending they could not entirely be separated from many watery parts with which they were intimately mixed, they drew down a part of these also with them; and these could not mount again after the surface of the earth was consolidated; they therefore surrounded the heavy first descending parts, in the same manner as these surround the central globe. Thus, the entire body of the earth is composed internally of a great burning globe, next which is placed a heavy terrene substance that encompasses

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passes it, round which also is circumfused a body of water. Upon this body of water, the crust of the earth on which we dwell is placed, so that, according to him, the globe is composed of a number of coats, or shells, one within the other, all of different densities. The body of the earth being thus formed, the air, which is the lightest substance of all, surrounded its surface, and the beams of the sun darting through, produced that light which, we are told, first obeyed the Creator's command.

The whole economy of the creation being thus adjusted, it only remained to account for the risings and depressions on the surface of the earth, with the other seeming irregularities of its present appearance. The hills and valleys are considered by him as formed by their pressing upon the internal fluid, which sustains the outward shell of earth with greater or less weight; those parts of the earth which are heaviest, sink into the subjacent fluid more deeply, and become valleys; those that are lighter, rise highest upon the earth's surface, and are called mountains.

Such was the face of nature before the deluge; the earth was then more fertile and populous than it is at present; the life of man and animals was extended to ten times its present duration; and all those advantages arose from the superior heat of the central globe, which ever since has been cooling. As its heat was then in full power, the genial principle was also much greater than at present; vegetation and animal increase were carried on with more vigour; and all nature seemed teeming with the seeds of life. But these physical advantages were only productive of moral evil; the warmth which invigorated the body, increased the passions and appetites of the mind; and as man became more powerful, he grew less innocent. It was found necessary to punish this depravity; and all living creatures were overwhelmed by the deluge in universal destruction.

This deluge, which simple believers are willing to ascribe to a miracle, philosophers have been long desirous to account for by natural causes. They have proved that the earth could never supply from any reservoir towards its centre, nor the atmosphere by any discharge from above, such a quantity of water as would cover the surface of the globe to a certain depth over the tops of our highest mountains. Where, therefore, was all this water to be found? Whiston has found enough, and more than a sufficiency, in the tail of a comet; for he seems to allot comets a very active part in the great operations of nature.

He calculates with great seeming precision, the year, the month, and the day of the week on which this comet (which has paid the earth some visits since, though at a kinder distance) involved our globe in its tail. The tail he supposed to be a vaporous fluid substance, exhaled from the body of the comet, by the extreme heat of the sun, and increasing in proportion as it approached that great luminary. It was in this that our globe was involved at the time of the deluge; and as the earth still acted by its natural attraction, it drew to itself all the watery vapours which were in the comet's tail; and the internal waters being also at the same time let loose, in a very short space the tops of the highest mountains were laid under the deep.

The punishment of the deluge being thus completed, and all the guilty destroyed, the earth, which had been broken by the eruption of the internal waters, was also enlarged by it; so that upon the comet's recess, there was found room sufficient in the internal abyss for the recess of the superfluous waters, whither they all retired, and left the earth uncovered, but in some respects changed, particularly in its figure, which, from being round, was now become oblate. In this universal wreck of nature Noah survived, by a variety of happy causes, to repeople the earth, and to give birth to a race of men slow in believing ill-imagined theories of the earth.

Sect. IV. *Theory of Buffon.*

Theory of Buffon. 184

Less abstracted and more popular than the theory of Whiston, but equally fanciful and pompous, was the hypothesis of Buffon. This system, which was received with great admiration, depends principally on two facts which, though generally true, were by Buffon extended much too far.

It had been long observed, that such flinty or siliceous bodies as form a part of the composition of glass, are among the most abundant materials which compose the earth, and that many of them nearly resemble glass in colour, transparency, lustre, hardness, and specific gravity. As glass is produced by fusion in a strong heat, it was inferred by Buffon, that the flinty bodies found on the earth derived their origin from a similar fusion; and as no heat sufficient to produce so great an effect, could be found on our globe, the author has recourse to the sun as its source. He supposes the planets, and the earth among the number, to have originally formed a part of the body of the sun. In this situation a comet falling in on that great body, might have given it such a shock, and so shaken its whole frame, that some of its particles might have been driven off, like streaming sparkles from red-hot iron; and each of these streams of fire, though very small in comparison of the sun, might have been large enough to form a planet much greater than our earth, or any other of the planetary system. In this manner the planets, together with the globe which we inhabit, might have been driven off from the body of the sun by impulsion; and in this way they would have continued to recede from it for ever, had they not been arrested by the superior power of attraction, exerted on them by the sun; and thus, by the combination of the centrifugal and centripetal forces, they were whirled round in the orbits which they now describe.

After giving a number of reasons for the credibility, or at least possibility, of the foregoing supposition, the author concludes that it is evident, that the earth assumed its present figure when in a melted state. It is natural to think, says he, that the earth, when it issued from the sun, had no other form but that of a torrent of melted and inflamed matter; that this torrent, by the mutual attraction of its parts, took on a globular figure, which its diurnal motion changed into a spheroid; that, when the earth cooled, the vapours, which were expanded like the tail of a comet, gradually condensed, and fell down in the form of water upon the surface, depositing at the same time a slimy substance mixed with sulphur and salts, part of which was carried by the motion of the waters into the perpendicular fissures of the strata, and produced

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produced metals, and the rest remained on the surface, and gave rise to the vegetable mould which abounds in different places, with more or less of animal or vegetable particles, the organization of which is not obvious to the senses.

Thus the interior parts of the globe were originally composed of vitrified matter, and probably they are so at present. Above this were placed those bodies which had been reduced by the heat to the smallest particles, as sand, which are only portions of glass, and above these pumice stones, and the scoriæ of melted matter, from which were afterwards produced the several kinds of clay. The whole mass was covered with water to the depth of five or six hundred feet, arising from the condensation of the vapours when the earth began to cool. This water deposited a stratum of mud, mixed with all those substances which were capable of being sublimed, or exhaled by fire; and the air was formed of the most subtile vapours, which, from their small specific gravity, floated above the water.

Such was the condition of the earth, when the tides, the winds, and the heat of the sun, began to introduce changes on its surface. The diurnal motion of the earth, and that of the tides, elevated the waters in the equatorial regions, and necessarily transported thither great quantities of slime, clay, and sand; and by thus elevating those parts of the earth, they perhaps sunk those under the poles about two leagues, or a 230th part of the whole; for the waters would easily reduce into powder pumice stones, and other spongy parts of the vitrified matter upon the surface; and by this means excavate some places and elevate others, which, in time, would produce islands and continents, and all those inequalities on the surface, which are more considerable towards the equator than towards the poles. The highest mountains lie between the tropics and the middle of the temperate zones, and the lowest from the polar circles towards the poles. Indeed, both the land and sea have most inequalities between the tropics, as is evident from the incredible number of islands peculiar to these regions.

The other circumstance which forms a principal part of the basis of this theory, is derived from the composition of sea shells. It is well known that these shells consist chiefly of an earth like that which constitutes the principal part of limestone or marble; and it was hence inferred that, after a series of ages, these shells being broken down into minute particles, produced those immense masses of calcareous substances which are now found either in vast mountains, or in stratified plains, in almost every part of the earth.

Buffon conceives very naturally, that the surface of the earth must, at the beginning, have been much less solid than it is at present, and consequently the same causes which at this day produce but slight changes, must then, on so yielding a body, have been attended with very considerable effects. There is, he thinks, every reason to suppose, that the earth was at that time covered with the waters of the sea; and that these waters were above the tops of our highest mountains, since, even in such elevated situations, we find shells and other marine productions in very great abundance. It appears also that the sea continued for a considerable time upon the face of the earth; for as these layers of shells are found so very frequently at such great depths, and in such prodigious quantities, it seems impossible for such numbers to have been supported all alive at one time; so that they must have been brought there by successive depositions. These shells also are found in the bodies of the hardest rocks, where they could not have been deposited all at once, at the time of the deluge, or at any such instant revolution; since that would be to suppose, that all the rocks in which they are found were, at that instant, in a state of dissolution, which would be absurd to assert. The sea, therefore, deposited them wherever they are now to be found, and that by slow and successive degrees.

"It will appear also, that the sea covered the whole earth, from the appearance of its layers, which lying regularly one above the other, seem all to resemble the sediment formed at different times by the ocean. Hence, by the irregular force of its waves and its currents, driving the bottom into sand-banks, mountains must have been gradually formed within this universal covering of waters; and these successively raising their heads above its surface, must, in time, have formed the highest ridges of mountains upon land, together with continents, islands, and low grounds, all in their turns. This opinion will receive additional weight by considering, that in those parts of the earth, where the power of the ocean is greatest, the inequalities on the surface of the earth are highest; the ocean's power is greatest at the equator, where its winds and tides are most constant; and in fact, the mountains at the equator are found to be higher than in any other parts of the world. (Vid. N° 129.). The sea, therefore, has produced the principal changes in our earth; rivers, volcanoes, earthquakes, storms, and rain, having made but slight alterations, and only such as have affected the globe to very inconsiderable depths."

"In the formation of this theory, says Mr Kirwan, genius (I mean genius in its primitive sense, the sublime talent of fascinating invention, and not the energetic power of patient, profound, and sagacious investigation), unhappily presided. Yet dazzled by the splendid but delusive scenery, presented by an ardent imagination soaring to the source of light, and rending from its flaming orb the planetary masses that surround it; then marking with daring and overweening confidence, fancied successive epochs of the consolidated fabric of the terraqueous globe; the public attention was long arrested by the magical representation, and the understanding nearly betrayed into a partial, if not a total, assent to it.

"This proud gigantic theory, was, however, like another Goliath, soon demolished by a common flint or pebble, the very substance it sprung from. Common glass essentially contains an alkaline salt, to which alone it owes its fusibility; siliceous substances contain none, and are absolutely infusible when unassociated with any. Macquer found them infusible not only in furnaces, but in the still incomparably superior heat of inflamed oxygen. Hence the hypothesis grounded on the assumed identity of these substances and common glass, vanished like the unembodied visions of the night. With respect to limestone, the other pillar on which this theory rests, Cronstedt, Ferber, Born, Arduini, and Bergman, demonstrated the existence of numerous and immense mountains, in which not only no vestiges of shells could be traced, but whose internal structure of position

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position was incompatible with the supposition of origination thence derived." *

Kirwan's Geological Essays. 436

Sect. V. *Theory of Whitehurst.*

Theory of Whitehurst.

The first person who founded a theory of the earth on accurate and industrious observation was the late Mr John Whitehurst, who, in an inquiry into the original state and formation of the earth, has advanced opinions which differ considerably from those of preceding naturalists, and in some measures resemble those which are at present in greatest repute.

Mr Whitehurst sets out with stating his opinions, that the terraqueous globe, which we now inhabit, was originally in a fluid flate, and this, not from any solvent principle or subsequent solution, but owing to the first assemblage of its component parts; whence he presumes that the earth had a beginning, and has not existed from eternity. He rests his proof of this original fluid state of the earth on its spheroidal form, which a fluid globe in its revolution would naturally acquire, but which could not easily be produced in a solid body. The fluidity of the earth and the infinite divisibility of matter, an opinion which generally prevailed at that time, prove, according to him, that the component parts of the elements were uniformly blended together, none being heavier or lighter than another; hence they composed a uniform mass of equal consistence throughout, from the surface to the centre, and consequently the new formed globe was not adapted to the support of animal or vegetable life. It would therefore be absurd to suppose, that organized bodies were created during the chaotic state of the earth; and there is a great presumption that mankind were not created till the earth was become suitable to the nature of their existence.

The component parts of the chaos were heterogeneous, and endowed with peculiar chemical affinities, whereby similar substances were disposed to unite and form select bodies of various denominations, and thus the chaos was progressively formed into a habitable world.

The first operation of nature which presents itself to our consideration is the production of the spheroidal figure of the earth, acquired from its diurnal rotation, and the laws of gravity, fluidity, and centrifugal force. When this form was once completed, the component parts began to act on each other according to their affinities: hence the particles of earth, air, and water, united to those of their own kind, and with their union commenced their specific gravities; and the uniform suspension which had hitherto prevailed throughout the whole of the chaotic mass, was destroyed.

On the component parts separating into homogeneous masses, those of the greatest density began to approach towards the centre of gravity, and those of the greatest levity ascended towards the surface. As the specific gravity of air is so much less than that of water, it is presumed that the former escaped from the general mass sooner than the latter, and formed an impure atmosphere surrounding the newly-formed globe. Water being next in levity, succeeded the air, and formed one vast ocean about the earth. In process of time these elements became perfectly pure, and fit for the preservation of animal and vegetable life.

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When the component parts of the chaos had been thus progressively separated, and collected into distinct masses, the following consequences are supposed to have ensued. The solids could not uniformly subside from every part of the surface, and be equally covered by water; for, as the sun and moon were coeval with the chaos, in proportion as the separation of the solids and fluids increased, so, by the action of those bodies on the sea, the tides became greater, and removed the solids from place to place, without any order or regularity. Hence the sea became unequally deep; and those inequalities daily increasing, dry land gradually appeared, and divided the waters which had hitherto been universally diffused over the earth. The primitive islands being thus formed gradually became firm and dry, and fit for the reception of animals and vegetables.

The atmosphere, the sea, and the land, being thus formed, Mr Whitehurst proceeds to consider the order in which animal and vegetable bodies were severally created. He first supposes that, as the ocean became pure, and fit for animal life, before the formation of the primitive islands, fish were the first animals produced, and he supports this opinion by many ingenious arguments and facts. He observes, that in every instance upon record, the fragments of sea-shells are infinitely more numerous than the bones and teeth of fish. The latter, too, are but rarely deposited in any other matter than in beds of sand and gravel, and not in the solid substance of limestone, as the shells of fish generally are, even to the depth of many hundred yards, and dispersed throughout the whole extent of the secondary strata. Hence it is probable, that shell-fish were produced in prodigious quantities, sooner than any other kind of animal. The ocean being thus stocked with inhabitants, previous to the formation of the primitive islands, many of them became enveloped, and were buried in the mud by the action of the tides; and this would happen more particularly to the shell-fish, as they were less able to extricate themselves. Since the remains of marine animals are thus imbedded at various depths in the earth, there is sufficient proof that these marine bodies were entombed at successive periods of time, and that they were likewise created before the primitive islands, and consequently before any terrestrial islands.

That the earth has, at different times, suffered very violent convulsions, producing extensive ruptures of its solid parts, may reasonably be concluded from the rugged and uncouth appearance of many of the mountainous parts of the world. We see rocks in some places torn asunder, or appearing as if cut with a saw, and we find, in various parts, substances both mineral and organized, which are not generally met with, except in very distant regions. Most of the irregularities of the earth's surface are attributed by Mr Whitehurst to the general deluge. This would, in some instances, have the effect of reducing large masses of matter to a second state of solution; many eminences would be levelled, and some of the valleys would be filled up, while some parts which were before covered with water, might receive such an accession of matter as to fill up their cavities, and on the subsiding of the waters become a vast level plain. On the other hand, those elevated regions which were chiefly composed of the hardest stones, by having the lighter portions of earth washed

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away from their basis, would appear considerably increased in height. Mr Whitehurst attributes the production of pit coal also to the deluge, as it is difficult to account for the deposition of such a quantity of vegetable matter (supposing pit-coal to be of vegetable origin) below the surface of the earth, on any other hypothesis. The animal matters found in a fossil state, especially those remains of animals which are not now found upon the earth, can only be accounted for, on the supposition of a deluge.

Mr Whitehurst, however, is not content with attributing to the deluge most of the changes which have taken place on the surface of the earth, but he derives from the same source the curtailed longevity of man, and many of the evils incident to mankind. "At that dreadful era, says he, and not before, the year became divided into summer and winter, spring and autumn, and the spontaneous products of the earth no longer sufficed the calls of human nature without art and labour; wherefore he who sowed would expect to reap, and he who built an hut for his protection, would naturally expect to enjoy the fruits of his own labour; necessity, therefore, was the parent of property, and property created a thousand imaginary wants, which its possessors endeavoured to gratify, and their example excited similar ideas in those who had it not, but nevertheless studiously endeavoured to gratify their artificial wants by unjustifiable means. Hence the necessity of laws, dominion, and subordination, which had no existence in the antediluvian world.

"To that great revolution in the natural world, we may therefore ascribe many of the evils incident to mankind; for experience shews, that men who are born in rude and savage climates are naturally of a ferocious disposition; and that a fertile soil, which leaves nothing to wish for, softens their manners, and inclines them to humanity."

The above is a general outline of Mr Whitehurst's theory, some parts of which are very ingenious, and are corroborated by observation, while others are not a little fanciful and improbable. In his supposition that the earth was originally in fluid state, he agrees with most other theorists, as this is a circumstance which admits of little doubt; though, as Kirwan has shewn, it is not necessary to suppose that the whole mass of the earth was fluid, but only those parts of it which are near the surface. In his play of affinities, and consequent separation of the materials of the earth into homogeneous masses, Whitehurst has been followed by Mr Kirwan, who has framed a beautiful and ingenious speculation on the successive changes that took place from the action of the materials on each other ‡.

‡ *Kirwan's Geological Essays*, Essay I.

187 Mr Whitehurst has been betrayed by his fondness for a favourite theory, into several errors respecting the stratification of the earth, which require to be mentioned. Thus, though the arrangement of the strata, especially where it has not been disturbed by some evident and violent cause, is extremely uniform; he has, however, extended this regularity farther than it really obtains. He tells us that the strata invariably follow each other, as if it were in an alphabetical order, or a series of numbers, whatever be their denomination. Not that they are alike in all the different regions of the earth, either in quality or in thickness, but that their order in each particular part, however they may differ in quality; yet they follow each other in regular succession, both as to thickness and quality, insomuch, that by knowing the incumbent stratum, together with the arrangement thereof in any particular part of the earth, we may come to a perfect knowledge of all the inferior beds, so far as they have been previously discovered in the adjacent country. With respect to the strata that accompany coal, some instances are apparently but not really, contradictory to this rule.

We now know, however, that Mr Whitehurst's observations do not universally apply. In the old mines in the valley of Planen, in Saxony, the strata, though they are near each other, vary considerably in thickness, from that of a few inches to several feet, and the stratum of coal, in particular, varies from two to thirty-two feet. Again, in Mount Salive, the strata of coal, though in a calcareous mountain, vary considerably; and Mr Whitehurst himself informs us, that at Bensal moor, those strata which are in other places the lowest, are found at the surface. Even in Derbyshire, to which Mr Whitehurst's observations chiefly apply, we are informed that even when the arrangement is the same, the thickness of the strata varies considerably.

SECT. VI. *Theory of Dr Hutton.*

THE next theory which we have to consider, is that proposed by Dr James Hutton, which has become so much the object of inquiry and debate, as to give name to one of the two principal sects into which geologists are now divided. 188

Theory of Hutton.

The leading principles of the Huttonian theory, as concisely laid down by one of its greatest admirers and supporters, are the following.

1. The first circumstance which Dr Hutton has considered as a general fact is, that by far the greater part of the bodies which compose the exterior crust of our globe, bear the marks of being formed of the materials of mineral and organized bodies, of more ancient date. The spoils or the wreck of an older world are, he thinks, everywhere visible in the present, and though not found in every piece of rock, they are diffused so generally as to leave no doubt that the strata which now compose our continents are all formed out of strata more ancient than themselves.

2. The present rocks, with the exception of such as are not stratified, having all existed in the form of loose materials collected at the bottom of the sea, must have been consolidated and converted into stone by virtue of some very powerful and general agent. The consolidating cause which he points out is subterraneous heat, and the objections to this hypothesis have been attempted to be removed, by the introduction of a principle new and peculiar to himself. This principle is the compression which must have prevailed in that region where the consolidation of mineral substances was accomplished. Under the weight of a superincumbent ocean, heat, however intense, might be unable to volatilize any part of those substances which, at the surface, and under the lighter pressure of our atmosphere, it can entirely consume. The same pressure, by forcing those substances to remain united, which at the surface are easily separated, might occasion the fusion of some bodies which in our fires are only calcined.

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3. The third general circumstance which this theory is founded on is, that the stratified rocks, instead of being either horizontal or nearly so, as they no doubt were originally, are now found possessing all degrees of elevation, and some of them were perpendicular to the horizon; to which we must add, that those strata which were once at the bottom of the sea, are now raised up, many of them several thousand feet above its surface. From this, as well as from the inflexions, the breaking and separation of the strata, it is inferred, that they have been raised by the action of some expansive force placed under them. This force, which has burst in pieces the solid pavement on which the ocean rests, and has raised up rocks from the bottom of the sea into mountains 15,000 feet above its surface, exceeds any which we see actually exerted, but seems to come nearer to the cause of the volcano or the earthquake than to any other, of which the effects are directly observed. The immense disturbance, therefore, of the strata, is in this theory ascribed to heat acting with an expansive power, and elevating those rocks which it had before consolidated.

4. Among the marks of disturbance in which the mineral kingdom abounds, those great breaches among rocks, which are filled with materials different from the rock on either side, are among the most conspicuous. These are the veins, and comprehend not only the metallic veins, but also those of whinstone, of porphyry, and of granite, all of them substances more or less crystallized, and none of them containing the remains of organized bodies. These are of posterior formation to the strata which they intersect, and in general also they carry with them the marks of the violence with which they have come into their place, and of the disturbances which they have produced on the rocks already formed. The materials of all these veins, Dr Hutton concludes to have been melted by subterraneous heat, and, while in fusion, injected among the fissures and openings of rocks already formed, but thus disturbed, and moved from their original place.

This conclusion he extends to all the masses of whinstone, porphyry, and granite, which are interspersed among the strata, or raised up in pyramids, as they often appear to be, through the midst of them. Thus, in the fusion and injection of the unstratified rocks, we have the third and last great operation which subterraneous heat has performed on mineral substances.

5. From this Dr Hutton proceeds to consider the changes to which mineral bodies are subject when raised into the atmosphere. Here he finds, without any exception, that they are all going to decay; that, from the shore of the sea to the top of the mountain, from the softest clay to the hardest quartz, all are wasting and undergoing a separation of their parts. The bodies thus resolved into their elements, whether chemical or mechanical, are carried down by the rivers to the sea, and are there deposited. Nothing is exempted from this general law; among the highest mountains and the hardest rocks, its effects are most clearly discerned; and it is on the objects which appear the most durable and fixed, that the characters of revolution are most deeply imprinted *.

* Edinburgh Phil. Trans. vol. i. p. 52.

It is not surprising that this theory should have met with many advocates among the more superficial observers of nature. The production of a man in whom genius, observation, and industry, were united, and who passed a considerable part of a long life in chemical and geological researches, was calculated to dazzle the imagination by the grandeur of its design, and to captivate the judgment by its appearance of regularity and consistence. It has been considered as a peculiar excellence of this theory, that it ascribes to the phenomena of geology an order similar to that which exists in the provinces of nature with which we are best acquainted; that it produces seas and continents, not by accident, but by the operation of regular and uniform causes; that it makes the decay of one part subservient to the restoration of another, and that it gives stability to the whole, not by perpetuating individuals, but by reproducing them in succession †.

† *Playfair's Illustrations*, p. 129.

189 Objections to the Huttonian theory.

An hypothesis with such pretensions could not fail of being minutely examined and severely criticised by the more enlightened part of geologists, and accordingly very serious objections have been made to it by Kirwan and others. We shall state a few of what appear to us to be the most convincing arguments against Dr Hutton's theory, referring those who wish to see a more detailed refutation of it to the geological writings of Kirwan, and A Comparative View of the Huttonian and Neptunian Theories.

190 From the nature and action of caloric.

Some of the strongest arguments against this theory are drawn from the nature of caloric, and what we know of its action on other bodies. We know that caloric is of so diffusible a nature, that it is always communicated, from that body or set of bodies, in which it is most abundant, to that in which it is less so, till an equilibrium of temperature is produced. But Dr Hutton's theory supposes a subterraneous heat as constantly existing, capable of fusing the most obdurate rocks, and of raising them by its expansibility from the bottom of the ocean, and yet incapable of extending its influence through the superincumbent strata at all times, so as to fuse or evaporate superior bodies, and gradually expand itself, so as to acquire that equilibrium which is one of its natural effects. Again, supposing such a subterraneous heat to exist, it is surely extraordinary, that substances which we are incapable of fusing by the strongest heat that we can excite, even in the greatest state of division, should, by this subterraneous heat be so completely fused, and in such vast masses, as to have assumed the appearance under which they now present themselves. If the solar rays, in the utmost state of concentration, if a united stream of inflamed hydrogenous and oxygenous gases from the tube of a blow-pipe or gazometer, cannot melt the smallest visible portion of calcareous spar or rock crystal, how can we conceive that the immense mountains of limestone and of quartz which are met with in so many places could have been fused into a state of perfect fluidity? Or even if they could be fused, how is it possible that the carbonic acid of the limestone should not have been dissipated by so strong a heat? If we suppose with Dr Hutton, that this subterraneous heat acts with the assistance of immense pressure from the superincumbent strata and waters of the ocean, hence preventing the dissipation of volatile matters, still it should act uniformly, and should fuse all those bodies which come in its way, that are capable of fusion. Now, we know that feldspar, schorl, mica, and chlorite, are much more fusible than quartz, and of course, when a mass compounded of these comes

under

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under the influence of this heat, all these more fusible substances should be melted as well as the quartz. But in some stones in which most of these ingredients meet, as in the granite of Portsoy, there is every reason to suppose that some of them have been in a fluid state, while the others were solid or less fluid, as crystals of the latter are impressed on a bed of the former, viz. in the instance cited, crystals of feldspar in a mass of quartz. As it is certain, according to the advocates of the Huttonian theory, that at least the quartz was fluid when it was moulded on the feldspar, how happened it that this comparatively fusible stone was not also melted, and blended in one compact mass with the quartz? We also frequently find crystals of quartz penetrated by schorl and chlorite, which is a proof that the latter must have been hard while the former was in a fluid state. Hence it is evident that these appearances could not have been the effect of fusion by heat. Again, we find seams of coal penetrated by thin laminæ and crystals of quartz, an effect which, according to this theory, must have taken place while the quartz was in a state of fusion. But, in this case, the strata of shale above and below the coal should also have been fused (shale being much more fusible than quartz), and thus the whole should have acquired a slaty texture; and besides in this intense heat, the coal should have been entirely charred and lost all its vegetable impressions.

The very existence of such a subterraneous heat, that constantly maintains itself without fuel, ready to act on any emergency, when a quantity of the old world has been abraded and translated, sufficient to furnish the materials of a new one, is avowedly hypothetical, as we have no proof that it exists. Nay, we have direct proof, as far as rational induction can carry us, to the contrary. It was long ago observed, by Irving and Forster, that the heat of the sea diminishes in proportion to the depth to which we proceed in examining it, and the same has been more lately proved by Peron, by various trials in many different latitudes †. Now the contrary of this ought certainly to happen, (unless this subterraneous heat is entirely unlike common heat) if there constantly existed in the bowels of the earth a heat capable of fusing quartz and limestone.

† *Journ. de Phys.* tom. lx. p. 81.

The structure of whin dykes, detailed in Section II. of last Chapter, affords additional arguments in opposition to the Huttonian theory.

191
From the structure of whin dykes.

The evidence which Dr Hutton has adduced to prove the subterraneous eruption of dykes, is drawn from the apparent derangement of the horizontal strata at a place where they are intersected by a dyke, and the peculiar appearance of the coal in their immediate vicinity, which he supposes to be in a state of calcination, from having been in contact with the ejected matter of the dyke in fusion. Let us first attend to the effect of this eruption of a dyke, the apparent derangement of the strata; and let us consider for a moment, what must be the mechanical operation of a mass of this liquid matter bursting upwards through the coal strata. Suppose a coal field of a mile square in extent; suppose that the coal and concomitant strata are perfectly regular, having a moderate *dip* or inclination to the south; and suppose that this coal field is to be intersected by a dyke, ejected in a state of fusion from the bowels of the earth. Considering the nature of the strata which usually accompany coal, such as sandstone, limestone, ironstone, &c. which are very hard and compact, we must allow, that the resistance from such substances would be very great. In this previous state of circumstances, then, what would be the effect of the eruption of a dyke in the middle of the field, in a direction from north to south? Can it even be imagined, that this liquid mass in its progress upwards through the superincumbent strata to the surface of the earth, would merely destroy the continuity of these strata, and not in its irresistible course, carry along with it part of all the substances composing that strata through which it passed? But farther, one of the most obvious consequences of such an eruption, would be the elevation of part of the whole range of the strata on both sides of the dyke, and the extent of this elevation will be in proportion to the power or thickness of the dyke; and, not only is it natural to expect this elevation of the strata to a certain extent, but from the operation of an agent so tremendous and irresistible, that the whole strata should be broken, disjointed, and confused. But does this statement correspond with the phenomena? From the history of dykes traversing coal strata, we know that it does not. On the contrary, the whole of the strata, in most cases, preserve the same thickness, the same parallelism, and the same inclination to the horizon on both sides of the dyke. It is true, the half mile of coal field intersected by a dyke, as we have supposed above, will on one side of it be elevated or depressed. If the dyke, which runs north and south in its course upwards, inclines to the west, the western division will be elevated. But this is not a partial elevation only in the immediate vicinity of the dyke. It extends over the whole field on the west side of the dyke, and the strata continue fair and regular, in all respects corresponding to those from which they have been detached, till they are intersected by another dyke.

From this reasoning, we think the conclusion fair and obvious, that dykes intersecting coal strata have not been formed by subterraneous eruption, and therefore, that the elevation or depression of the strata is not owing to this cause. Dr Hutton's theory, in this respect, is opposed by the facts which it professes to explain, and consequently it is untenable.

Let us now consider the argument drawn from the supposed calcination of the coal which has been in contact with the matter of the dyke in a state of fusion. Here Dr Hutton seems to have overleaped the bounds of his own theory, and lost sight of his own principles, which suppose, that all the strata and stony matters of which the globe is composed, have been consolidated by means of heat; that the exhibition of the common or ordinary phenomena of heat is not to be looked for in the grand processes of nature; because these operations have taken place at great depths in the bowels of the earth, or under immense pressure at the bottom of the sea; and this is the reason that coal, and lime strata, for instance, which have been subjected to this intense degree of heat discover no marks of calcination, the one being deprived of its carbonic acid, and the other of its bitumen. Now, granting this hypothetical argument to be well founded, what is the reason that the coal, which is in contact with a dyke, has undergone the processes of calcination, when this coal is at as great a depth in the bowels of the earth, under as immense pressure, and as much

much excluded from atmospheric air, as any coal at its original formation. But all the coal in contact with a dyke, is not in this state. Clean coal is sometimes found in immediate contact; and, in many places, clean coal is also found intercepted between regular ranges of basaltic columns, and this coal discovers not the smallest mark of calcination. On the other hand, coal in this supposed state of calcination, has been frequently discovered, at a great distance from any dyke or basaltic substance whatever. Masses of this foul coal often occur, to the regret and disappointment of the miner, in the midst of strata otherwise perfectly clean and regular. This last fact shews us, that we must look for the cause of this singular phenomenon elsewhere than in the circumstance of the coal having been in contact with a dyke while in fusion; for it appears that the effect does not always follow in the same circumstances, and that the same effect is produced in very different circumstances.

These observations are probably sufficient to shew that the above argument in proof of the subterraneous eruption of dykes, is equally unsatisfactory in explaining the phenomena, and consequently equally untenable with the former. Both, therefore, must fall to the ground.

The wedge-like form of dykes might be adduced as another argument against their formation by subterraneous eruption; for it is not easy to conceive that a dyke in a state of fusion should, in its eruptive progress towards the surface of the earth, enlarge and become thicker.

The history of metallic veins furnishes us with stronger objections against Dr Hutton's theory. If, according to this theory, metallic veins have been formed by the substances they contain being ignited in a state of fusion from the bowels of the earth, it will naturally follow, that the veins thus formed might be traced to the greatest depths, and even to the subterraneous furnace from which they issued. But we know that the fact is quite otherwise. The termination of many veins downwards has been discovered. Even the most powerful and productive have been unexpectedly cut off by the horizontal strata, and no vestige of them could ever be traced. This was the case with the rich vein of lead ore at Llangunog in Wales. It is the case also with many veins in their course downwards, to diminish gradually in form of a wedge, and then they are lost for ever. Now, this certainly could never have happened, had they been formed by subterraneous eruption. Some trace of their progress, some mark of their course through the intersected strata, would still have remained. But no such indications, no such traces, are found. We must therefore conclude, that metallic veins have not been formed in this way, and that this theory, which appears to be so much at variance with facts, will not account in a satisfactory manner for their formation.

The masses of stone of the same species with the neighbouring superior strata, sometimes rounded and worn by the action of water, which are found at great depths in mineral veins, and organized substances, petrifactions of vegetables and animals, present us with another objection to this theory, equally strong and insurmountable. These substances are the productions of the surface of the earth; and even supposing them to have existed in the bowels of the earth, it is inconceivable that they should have retained their primitive form after they were subjected to so high a temperature as is necessary to hold metals in a state of fusion.

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Sect. VII. *Theory of Werner.*

193 Theory of Werner.

The latest, and perhaps most celebrated, theory that has yet appeared, is that of Professor Werner of Freyberg, with an account of which, and some observations on Mr Kirwan's opinions, we shall close this chapter.

We have said already, (N° 1.) that the subject of which we are now treating is called by Werner *geognosy*, and his pupils are commonly called *geognosts*.

Werner is of opinion, that our knowledge is already sufficiently advanced to form a rational theory respecting the formation of the *exterior crust* of our globe; for he does not deny that we cannot reason with respect to what is below this, since we have no fact which can give us the least notion with respect to it. We are only certain that some part of our globe has been in a fluid state, as is proved by its spheroidal form. The crystalline form of granite and other rocky substances which constitute the base of that part of the earth with which we are acquainted, are, according to Werner, sufficient proofs that this part at least has been in a state of minute dissolution. Again, the stratified appearance of most mountains and rocks shew that they are an accumulation of precipitates or sediments which have been deposited one over another. The numerous remains of marine animals which are found imbedded in many rocks, and of which some species are still found in our seas, allow us to believe that this solution was aqueous; that it was a vast ocean which has covered our globe to a very considerable height. *The exterior part of the globe*, then, *has been entirely dissolved by the waters which surrounded it, and from this solution certain chemical precipitations took place, which have formed the crust that we now see.*

In framing his theory, Werner professes to banish every thing that is hypothetical, and only to draw from general facts such immediate consequences as he believes it impossible not to deduce from them, and on these alone he founds his geognosy. The object of this theory, according to one of his disciples (the translator of his book on metallic veins), is to acquire a knowledge of the structure of the solid crust of the terraqueous globe, and the relative disposition of the materials which compose it; the means of doing this are to be derived from observation. Werner sets out with stating, that the chemical precipitates that took place from the chaotic fluid, did not form a regular surface, but that they collected here and there so as to produce the primitive mountains. These mountains he calls chaotic, because, says he, they have been formed during the period when the surface of the earth was a sort of chaos. After the retreat of the waters, these elevated parts were first discovered. They were exposed to the destructive action of the elements, and the shock of tides and torrents. The valleys were hollowed out, and the mountains acquired nearly the form in which we now see them.

Observation has shewn that the strata of which the earth is composed, may be divided into a certain number of congeries, each of which is composed of a certain

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tain set of minerals that are nearly the same in whatever part of the world the congeries is found. To these congeries Werner has given the name of formations, of which he distinguishes six kinds or classes, four universal, being found all over the globe, and two partial, found only in particular districts. These formations he has arranged according to the order in which he conceives them to have been produced, beginning with that formation which lies next the solid nucleus of the earth, and which may therefore be conceived to be the oldest, and ending with the most superficial, which is considered as the newest formation.

The first of these classes is called by Werner that of *primitive formations*, which consist of a number of formations lying above each other, being those which are supposed the oldest, as in these no organic remains have been discovered. The substances constituting this class are *granite*, *gneiss*, *micaceous schistus*, *argillaceous schistus*, *primitive limestone*, *primitive trap*, *syenite*, and *porphyry*. Of these the granite is the lowest, and therefore is considered as the oldest; and next this follow the others in the order in which we have enumerated them, except that the primitive limestone, and primitive trap, are found in an uncertain order, alternating with gneiss, argillaceous schistus, or micaceous schistus; and are therefore considered as subordinate to these formations.

When the waters had subsided, and the summits of the primitive mountains had been uncovered, organized bodies were produced; and part of these being intercepted among the chemical precipitations which were still going on, and the mechanical precipitations which now began to take place, were carried with these to the flanks of the primitive mountains, and the valleys between them. Hence were produced a second series of formations, which are called by Werner *transition formations*, or *rocks of transition*, as he considered them to be deposited during the period when the earth was passing from an uninhabited to an inhabited state. Among these formations, however, the organic remains are but few. The substances composing this class, are *transition limestone*, *gray wacke*, *gray wacke slate*, *transition trap*, *siliceous schistus*. Of these the two last are subordinate, alternating with gray wacke and gray wacke slate.

The third formation is what Werner calls *floetz formation*, or that, in which the beds or strata lie nearly horizontal, appearing as if they had been deposited from water. This formation comprehends most of what are usually called secondary strata. It is divided by Werner into three subformations, named from the variety or situation of the sandstone, which forms a principal part of each; as, 1. Old red sandstone formation, composed of *floetz limestone*, *old red sandstone*, and *foliated gypsum*. 2. Second sandstone formation, composed of *sandstone*, *floetz limestone*, and *fibrous gypsum*. 3. Third sandstone formation, composed of *sandstone*, *limestone*, and *chalk*, &c. Of these, as before, the first mentioned is the oldest, and in this, somewhere near the gypsum, there is usually found salt or sulphur. In this formation, organic remains are first seen in any great quantities.

The fourth formation is called *independent coal formation*, because in this coal is first found, and because it is not universally spread over the earth as the three preceding, but is collected in insulated masses, independent of each other. This is also divided into three, each successively more recent than the preceding. The first series of strata consist of *slate clay*, *limestone*, *marl*, *soft sandstone*, *greenstone*, *argillaceous ironstone*, *shale*, and *coal*; the second of *indurated clay*, *marl*, *limestone*, *porphyritic stone*, and *coal*; and the third of *loose sandstone*, *conglomerate*, (a variety of sandstone), *slate clay*, and *coal*.

The fifth is called *floetz trap formation*, so called because the *beds* of which it is composed, consist of materials that are mostly of the nature of *trap*, or whinstone. The substances that compose this formation are *gravel*, *sandstone*, *siliceous sandstone*, *clay*, *wacke*, *basalt*, *greenstone*, *schistose porphyry*, *pitchstone*, and *graystone*. *Coal* is also found in this formation, somewhere among the beds of *siliceous sandstone*, *clay*, *wacke*, and *basalt*, to which it is therefore considered as subordinate (F).

The sixth and last formation is the *alluvial formation*, or that which has arisen from the action of lakes and rivers, washing down part of the older strata. This is divided into two series of strata; the first being those that have arisen from the action of lakes newly drained, comprehending *marl*, *sand*, *clay*, and *coal*; and the second, those which have been produced from the action of rivers, comprehending *mud*, *ironstone*, *sand*, *peat*, &c. This formation is the most recent of any, but, like the fourth, it is only partial.

The above is an outline of Werner's geognosy, which is considered as an improvement of what is called the *Neptunian theory*, or that which explains geological appearances by the action of water, in opposition to what is called the *volcanic theory*, or that which attributes these appearances to an igneous origin.

19. Objections to the theory of Werner.

One of the principal objections to the Neptunian theory is drawn from the insolubility in water of many of the substances which compose our globe; but this the Neptunians endeavour to explain, by supposing that at the very commencement of their existence these substances were in that state of minute division which aqueous solutions require, but which no known existing quantity would be able to effect, after the substances had acquired their utmost consolidation, as it is well known, that a solid substance may be kept in solution, at least for a short time, in a less quantity of fluid than was originally requisite to dissolve it.

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(F) We may here notice Werner's opinion with respect to the formation and situation of basalt; as this is the only theory of importance respecting it, that has not been mentioned under the article BASALTES. "I am perfectly convinced (says Werner in a late memoir) that all the varieties of basalt have been produced in the humid way, and that they are of a very recent formation; that they formerly composed a great bed of immense extent, covering both the primitive and secondary strata; that time has anew destroyed a considerable part, and has left only the basaltic eminences which we now see." Vid. *Jameson's Mineralogy of Dumfries*, p. 184.

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A second objection is derived from the difficulty of supposing that these substances could have been consolidated below water, or that the water could completely shut up the pores of a body, to the entire exclusion of itself; so that had the mineral substances been consolidated as here supposed, the solvent ought either to remain within them in a liquid state, or, if evaporated, should have left the pores empty, and the body pervious to water.

Mr Playfair argues strenuously against the notion of these substances being precipitated from the chaotic fluid, which has been so ingeniously supported by Kirwan, who ascribes the solution of all substances in the chaotic fluid to their being finely pulverised, or created in a state of the most minute division; and the solvent being then insufficient in quantity, he supposes that, on that account, the precipitation took place the more rapidly.

"If, says Mr Playfair, he means by this to say, that a precipitation without solution would take place the sooner, the more inadequate the menstruum was to dissolve the whole, the proposition may be true, but will be of no use to explain the crystallization of minerals, the very object he has in view; because to crystallization it is not a bare subsidence of particles suspended in a fluid, but it is a passage from chemical solution to non-solution, or insolubility, that is required.

"If on the other hand he means to say, that the solution actually took place more quickly, and was more immediately followed by precipitation, because the quantity of the menstruum was insufficient, this is to assert that the weaker the cause, the more instantaneous will be its effect *."

* Playfair's Illustrations, sect. 51.

Werner's theory of dykes and veins.

Werner's theory of dykes and veins requires a more particular consideration.

This theory supposes, that the spaces which are now occupied by vertical strata, or dykes, including also metallic veins, were originally fissures, formed by the operation of different causes.

1. The unequal height and density of mountains, are considered as the most general causes of fissures. When the mountains were in a soft and humid state, that side which was least supported not only separated by its own weight, but the whole strata of the side gave way, and sunk below their former plain. This also seems to be the opinion of Saussure, with regard to the formation of fissures. It is not to be expected, that events of this kind should be of frequent occurrence, now that mountains have acquired sufficient firmness and stability to resist the force of gravity, operating in consequence of the inequality of weight and diversity of the materials of which they are composed. Instances, however, of the operation of such causes are not altogether wanting, even in modern times. After a season of excessive rains, in the year 1767, similar fissures were formed in mountains in Bohemia and Lusatia.

2. When the waters covered the surface of the earth, the unequal weight of the mountains was supported by their pressure; but when the waters retreated, this pressure was removed, the equilibrium was destroyed, the unsupported side of the mountain separated and sunk; and in this manner a fissure was formed.

3. The evaporation of the moisture, after the retreat of the waters, and the consequent diminution of bulk by contraction of the substances which enter into the composition of mountains, are also considered as the causes of fissures.

4. Fissures, too, derive their origin from other local and accidental causes, and especially from earthquakes. In the year 1783, when Calabria was afflicted with this most dreadful of all calamities which visit the earth, mountains were separated, exhibiting fissures similar to those which are now occupied by vertical strata.

The second part of the theory is employed in proving that the empty spaces, occasioned by the operation of one or other of the causes which have been enumerated, were filled from above; that the different substances, of which the vertical strata are composed, were held in solution by the waters which covered the earth; and that they were precipitated, by different chemical agents, according to the order of chemical affinity, and deposited in the places which they now occupy. In support of the opinion, that these fissures were filled from above, Werner adduces facts of angular and rounded fragments of stones of various species, and organized bodies, as marine shells and vegetables, having been found in vertical strata, at the immense depth of 150 and 200 fathoms. It may be doubted, on good grounds, whether this theory, supported by all the ingenuity and experience of its author, will account in a satisfactory manner, for that regularity of position and arrangement which are discovered in the vertical strata; for, notwithstanding the seeming disorder which a superficial vein may exhibit, they are not less regular and uniform than the horizontal strata. And when our researches are extended beyond the narrow bounds within which they are at present limited, when we are better acquainted with their relative positions and connexions, this uniformity and regularity will become more conspicuous. It may be doubted whether the fortuitous operation of such causes as have been stated, be equal to the effect of the formation of the vertical strata, as they now appear.

But, supposing that fissures were produced by some of the causes which have been mentioned, few of these causes could operate till the retreat of the waters left the mountains uncovered. It was only then that the mountains, by the inequality of height and density, being left unsupported, separated, and sunk from their former situation; it was then only that the process of evaporation could take place, succeeded by diminution of bulk and consequent contraction. In short, none of the causes which have been stated, could have any effect before the waters had retreated, excepting earthquakes; of the operation of which there is no proof previous to that period. The materials which compose the vertical strata, it is said, were formed by deposition from the waters which covered the mountains, holding them in solution. But before the fissures could be formed to receive these materials by precipitation and deposition, the waters had retired. A second deluge must therefore have happened, from the waters of which the various substances which enter into the composition of vertical strata have been deposited. This the theory does not suppose to have taken place; and, without such a supposition, it seems to be attended with considerable difficulty. But another difficulty still remains. It does not appear how the peculiarity of structure,

structure, which was mentioned in our account of whin dykes, Sect. II. of the last chapter, can be accounted for by the principles of this theory. If it be granted, that the horizontal strata were formed in the humid way, the materials of which they are composed must have been precipitated from the waters which held them in solution, by the laws of chemical affinity. But the vertical strata are supposed to have been formed in the same manner, and according to the same process. Now, this being the case, What is the reason that the vertical strata should exhibit a peculiarity of structure and arrangement, different from the horizontal strata? Some of the whin dykes which have been already described, are very remarkable for this singular structure, especially those which assume the form of prismatic columns. These columns are in the horizontal position; and, excepting the latter circumstance, these dykes, in every respect, resemble a basaltic stratum, in which the columns are perpendicular.

More arguments might be adduced in opposition to the theory of Werner; but we must hasten to conclude this chapter, with mentioning a few of Mr Kirwan's peculiar opinions.

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Kirwan's theory of the declivities of mountains.

Among these, the manner in which he accounts for the unequal declivities of the sides of mountains, forms one of the most conspicuous objects: and to this we shall principally confine ourselves, and shall give it in his own words, as extracted from his essay on the declivities of mountains, to which we were obliged in the first section of Chap. II.

" To assign the causes of this almost universal allotment of unequal declivities to opposite points, and why the greatest are directed to the west and south, and the gentlest, on the contrary, to the east and north, it is necessary to consider,

" 1. That all mountains were formed while covered with water.

" 2. That the earth was universally covered with water at two different eras, that of the creation, and that of the Noachian deluge.

" 3. That in the first era we must distinguish two different periods, that which preceded the appearance of dry land, and that which succeeded the creation of fish, but before the sea had been reduced nearly to its present level. During the former, the primeval mountains were formed; and during the latter, most of the secondary mountains and strata were formed.

" 4. That all mountains extend either from east to west, or from north to south, or in some intermediate direction between these cardinal points, which need not be particularly mentioned here, as the same species of reasoning must be applied to them, as to those to whose aspect they approach most.

" These preliminary circumstances being noticed, we are next to observe that, during the first era, this vast mass of water moved in two general directions, at right angles with each other, the one from east to west, which needs not to be proved, being the course of tides which still continue, but were in that ocean necessarily stronger and higher than at present; the other from north to south, the water tending to these vast abysses then formed in the vicinity of the south pole, as shewn in my former essays. Before either motion could be propagated, a considerable time must have elapsed.

" Now the primeval mountains formed at the commencement of the first era, and before this double direction of the waters took place, must have opposed a considerable obstacle to the motion of that fluid in the course that crossed that of the direction of these mountains. Thus the mountains that stretch from north to south must have opposed the motion of the waters from east to west; this opposition diminishing the motion of that fluid, disposed it to suffer the earthy particles with which in those early periods it must have been impregnated, to crystallize or be deposited on these eastern flanks, and particularly on those of the highest mountains, for over the lower it could easily pass; these depositions being incessantly repeated at heights gradually diminishing as the level of the waters gradually lowered, must have rendered the eastern declivities or descent, gentle, gradual, and moderate, while the western sides receiving no such accessions from depositions, must have remained steep and craggy.

" Again, the primeval mountains that run from east to west, by opposing a similar resistance to the course of the waters from north to south, must have occasioned similar depositions on the northern sides of these mountains, against which these waters impinged, and thus smoothed them.

" Where mountains intersect each other in an oblique direction, the north-east side of one range being contiguous to the south-west flanks of another range, there the influx of adventitious particles on the north-east side of the one, must have frequently extended to the south-west side of the other, particularly if that afflux were strong and copious; thus the *Erzgebirge* of Saxony, which run from west to east, have their north-east sides contiguous to the south-west side of the Riesengebirge that separate Silesia from Bohemia, and hence these latter are covered with the same beds of gneiss, &c. as the northern sides of the Saxon, and thereby are rendered smooth and gentle, comparatively to the opposite side, which, being sheltered, remains steep and abrupt, which explains the seventh observation.

" The causes here assigned explain why the covering of adventitious strata on the highest mountains is generally thinnest at the greatest height, and thickest towards the foot of the mountain; for the bulk of the water that contained the adventitious particles being proportioned to its depth, and the mass of earthy particles with which it was charged being proportioned to the bulk of the water that contained them, it is plain, that as the height of water gradually decreased, the depositions from it on the higher parts of the mountains must have been less copious than on the lower, where they must have been often repeated.

" Hence, 2. granite mountains, generally the most ancient, frequently have their northern or eastern sides covered with strata of gneiss or micaceous schistus, and this often with argillite or primeval sandstone, or limestone, these being either of somewhat later formation, or longer suspendible in water.

" Hence, 3. different species of stone are often found at different heights of the same flank of a mountain, according as the water which conveyed these species, happened to be differently impregnated at different heights. During the first era its depositions formed the primitive stony masses; after which the creation of fish, limestone, sandstone, (*puddingstone*) and secondary argillites, in which piscine remains are found, were deposited.

Theories of the Earth. ted. But during the second era, that of the Noachian deluge, by reason of the violence and irregularity of its aggression, the depositions were more miscellaneous, and are found at the greatest heights; yet in general they may well be distinguished by the remains of land animals, or of vegetables, or of both, which they present in their strata (or at least by the impressions of vegetables which they bear) as these must have been conveyed after the earth had been inhabited. But mountains regularly stratified bearing such remains, for instance the carboniferous, cannot be deemed to have been formed in a period so tumultuous. During this deluge the waters also held a different course, proceeding at first from south to north, and afterwards in both opposite directions, as shewn in treating of that catastrophe in my second essay.

"Hence, and from various contingent local causes, as partial inundations, earthquakes, volcanoes, the erosion of rivers, the elapsion of strata, disintegration, the disruption of the lofty mounds by which many lakes were anciently hemmed in, several changes were produced in particular countries, that may at first sight appear, though in reality they are not, exceptions to the operations of the general causes already stated.

"Thus the mountains of Kamtschatka had their eastern flanks torn and rendered abrupt by the irruption of the general deluge, probably accompanied by earthquakes. And thus the Meissener had its east and north flanks undermined by the river Warre, as Werner has shewn; thus the eighth and sixteenth observations are accounted for, as is the thirteenth by the vast inundations so frequent in this country, (1. *Pallas*, p. 172.), which undermined or corroded its east side, while the western were smoothed by the calcareous depositions from the numerous rivers in its vicinity.

"Hence, 4. we see why on different sides of lofty mountains different species of stones are found, as Pallas and Saussure have observed (2. *Sauss.* § 981.), a circumstance which Saussure imagined almost inexplicable, but which Dolomieu has since happily explained, by shewing that the current which conveyed the calcareous substances to the northern, eastern, and north-eastern sides of the Alps, for instance, was stopped by the height of these mountains, and thus prevented from conveying them to the southern sides, and thus the north-eastern sides were rendered more gentle than the opposite, (3. *New Roz.* p. 423.), conformably to the theory here given.

Hence, 5. where several lofty ridges run parallel to each other, it must frequently happen that the external should intercept the depositions that do not surround them, and thus leave the internal ridges steep on both sides.

"Hence, 6. low granitic or other primitive hills are frequently uncovered by adventitious strata on all sides, as at Phanet in the county of Donegal, or are covered on all sides; the impregnated waters either easily passing over them, or stagnating upon them, according to the greater or less rapidity of its course, and the obstacles it met with."

Kirwan's theory of dykes. Mr Kirwan's theory of the formation of whin dykes, is as follows.

He supposes that the dyke existed in the spot where it is found previous to the formation of the horizontal strata; that, during the formation of the latter by deposition, their equal extension on each side of the dyke was obstructed by its height preventing the passage of the current of waters; that the strata on that side of the dyke which were first formed, occasioned a much more considerable pressure than on the side on which the strata of later formation repose, and must have pulled the upper and more moveable extremity of the slip gradually towards the side on which there was least pressure; on that side it must therefore overhang: this pressure being of earlier date than on the opposite side, must have had a more considerable effect in depressing each particular stratum, and forcing their integrant particles into closer contact, than could have been produced in those of later formation; and consequently the strata must be lower. The ingenious author has added, with good reason, that he is not satisfied with this explanation. It is undoubtedly quite incompatible with the phenomena which it attempts to explain. For it has been already observed, that the coal and contiguous strata are, in every respect, the same on both sides of a dyke, to whatever distance they may have been elevated or depressed, which demonstrates clearly, that their formation must have been coeval. But, besides, the same derangement takes place in a slip where there is merely a solution of contiguity of the horizontal strata, one side being only elevated or depressed above or below the corresponding side from which it has been detached without having a vertical stratum or dyke interposed.

Chap. IV. *Of Earthquakes and Volcanoes.*

Earthquakes and Volcanoes.

In the preceding chapters we have given a short account of the materials which constitute the globe of the earth; we have taken a view of the relative position and connexion which subsist among these materials, so far as they are known, and we have considered some of the changes which are supposed to have taken place in their arrangement and distribution, and some of the theories which have been proposed to account for these changes. We have hitherto contemplated nature in a state of seeming repose, conducting her operations by a gradual and silent process, and accomplishing the most beneficial and wonderful effects, unheeded and unobserved. We are now to take a view of those more terrible and sudden changes which are exhibited in the devastation and ruin which accompany the earthquake and the volcano;—changes awful in the contemplation, but dreadful and terrible in their tremendous effects. 198

Many of the phenomena which accompany earthquakes and volcanoes, are common to both. Earthquakes are frequently the forerunners, and sometimes the attendants, of volcanic eruptions; but earthquakes have often existed, and their terrible effects have been severely felt, where no volcano was ever known.

In the present chapter, we propose to consider the phenomena, history, and causes of earthquakes and volcanoes, which will form the subjects of the two following sections. In the first we shall treat of earthquakes, and in the second of volcanoes.

Sect. I. *Of the Phenomena and History of Earthquakes.*

199 Places where earthquakes prevail.

Earthquakes have been felt in most countries of the world. There are, however, particular places, which

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which seem to be more subject to this dreadful calamity than others; and this does not seem to depend on any local circumstances, with regard to particular regions of the earth. It may be observed in general, that earthquakes are more frequent within the tropics; but there are places within the torrid zone, which are more rarely visited by earthquakes than some of the more temperate, or even the colder regions of the earth. In the islands of the West Indies, and in some parts of the American continent which lie between the tropics, the earthquake is more frequently felt than in most other regions of the earth. But the northern shores of the Mediterranean, the kingdom of Portugal, and some other places without the tropics, have been oftener the scene of desolation, by the effects of the earthquake, than many of the islands and extensive continents within the torrid zone. From this circumstance in the history of earthquakes, it would appear that they are not limited to particular regions, on account of proximity to the equator or distance from it, on account of insular situation or extent of continent. Particular islands, however, and particular parts of continents, have undoubtedly been oftener visited by earthquakes than others. Of all the islands of the West Indies, Jamaica has most frequently experienced their dreadful effects. Indeed, scarcely a year passes, without several shocks of an earthquake being felt in that island. Mexico and Peru in South America, are more subject to earthquakes than the other regions of the American continent. Portugal has been often shaken to the very foundations, by terrible earthquakes, while Spain, immediately adjoining, or, it may be said, including it, is, comparatively, almost exempted from their effects. It has been observed, that earthquakes have been less destructive in Italy than in Sicily, which are in the immediate vicinity of each other, and are both volcanic countries.

Observations on phenomena so awful and terrible, can scarcely be expected to be very numerous. The operation of the causes which produce them is too rapid, the effects are too sudden and unexpected, to be rendered the subject of accurate or attentive philosophical investigation; or, perhaps, we might acknowledge at once, that they are too extensive and too obscure for the powers of man. They are beyond the grasp of the human mind.

It has been already observed, that earthquakes are more frequent in volcanic countries than in any others. In these regions they are oftener dreaded and expected than in other places. Where a volcano exists, and when it has ceased to throw out flame and smoke for any long period, shocks of earthquakes begin to be dreaded. This has been very generally the case with the principal volcanoes of the world, the events of whose history have been recorded. An earthquake is often the forerunner of an eruption, and the very first warning of its approach.

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Phenomena which precede and accompany them.

Earthquakes are often preceded by long droughts. The earthquake, however, does not immediately succeed the cessation of the drought, or the fall of rain. Some electrical appearances are observed to take place in the air, before the earthquake comes on. The aurora borealis is frequent and brilliant, and bright meteors are often seen darting from one region of the heavens to another, or from the atmosphere to the earth.

Before the shock comes on, the waters of the ocean appear to be unusually troubled; without the effect of wind, or any perceptible cause, it swells up with great noise. Fountains and springs are also greatly disturbed, and their waters are agitated and become muddy. The air at the time of the shock has been observed to be remarkably calm and serene, but afterwards it becomes dark and cloudy.

The noise which accompanies the shock of an earthquake is sometimes like that of a number of carriages, driving along the pavement of a street with great rapidity. Sometimes it is like a rushing noise, similar to that of wind, and sometimes it resembles the explosions occasioned by the firing of artillery. The noise which accompanied the earthquake, which was pretty generally felt over Scotland about three years ago, we recollect, resembled that of a heavy person walking rapidly, and barefooted, through an adjoining room.

The effect of earthquakes on the surface of the earth is various. Sometimes it is instantaneously heaved up in a perpendicular direction, and sometimes assumes a kind of rolling motion, from side to side. Sometimes the shock commences with the perpendicular motion, and terminates with the other.

Great openings or fissures are made in the earth by the shock, and these in general throw out vast quantities of water, but sometimes smoke and flame are also emitted. Flame and smoke are often seen issuing through the surface of the earth, even where no chasm or fissures has been produced.

The effects of an earthquake on the ocean are not less terrible than those on land. The sea swells up to a great height; its waters sometimes seem to be entirely separated, and from the place of separation, currents of air, smoke, and flame, are discharged. Similar effects have been observed to take place in lakes, ponds, and rivers. Their waters are thrown into great agitation, and are sometimes swelled up. Places in which there was a considerable body of water, have become dry land, and dry land has been converted into an extensive lake by the shock of an earthquake.

The most terrible earthquake that has yet visited the earth, has never been felt over its whole surface. Their effects, however, extend to very distant regions, from the centre or principal scene of desolation. The existence of an earthquake is indicated much more extensively by water than by land. Where its effects have not been at all perceived on dry land, the agitation produced on the waters in the ocean, or in lakes and rivers, has been often communicated to a very great distance.

The duration of the shock of an earthquake rarely exceeds a minute, and perhaps very few continue for near that length of time. But the shocks are sometimes repeated in rapid succession; and perhaps from the effect on the senses, and the dread and alarm which are thus occasioned, it is supposed that their duration is much longer than it really is.

But as no general account of the phenomena which accompany an earthquake, from the difficulty or scantiness of observation, can be complete, it will be rendered much more intelligible and interesting, if we enter a little

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little more into the detail of the history of particular earthquakes; and in the account of some of them which we propose to lay before our readers, it will be found that most of the appearances and effects which have been enumerated, were observed.

Earthquake in Calabria 1638.

The first earthquake, the history of which we shall now detail, happened in Calabria, in the year 1638. This earthquake is rather to be considered as an exception to what was said with regard to their not taking place in the neighbourhood of a volcano, soon after an eruption. The volcanoes in that vicinity had experienced violent eruptions a very short time before. Five years before, there had been an eruption of Mount Vesuvius, and two years only had elapsed from the time that a similar event had befallen Ætna. This mountain, indeed, at the very time, threw out a great body of smoke, which seemed to cover the whole island, and entirely concealed the shores from view. The air over the sea at a little distance was calm and serene, and the surface of the water was perfectly smooth. Seemingly without any cause, it began to be slightly agitated, as happens to the surface of water in a heavy shower of rain. A dreadful noise succeeded, and the smell of sulphureous vapours was perceived. The noise, like the rattling of chariots, grew more frequent and loud, and the shock at last was terribly felt, when the earth was heaved up, or rolled in the form of waves.

This earthquake is particularly described by the celebrated father Kircher. "On the 24th of March, (says he), we departed in a small boat from the harbour of Messina in Sicily, and the same day arrived at the promontory of Pelorus. Our destination was for the city of Euphemia in Calabria, but unfavourable weather obliged us to remain at Pelorus three days. Wearied at length with delay, we determined to proceed on our voyage, and although the sea seemed unusually agitated, yet it did not deter us from embarking. As we approached the gulf of Charybdis, the waters seemed whirled round with such violence, as to form a large hollow in the centre of the vortex. Turning my eyes to Mount Ætna, I saw it throw out huge volumes of smoke, which entirely covered the island. This awful appearance, with the dreadful noise, and the sulphureous smell which accompanied it, filled me with strong apprehensions that some terrible calamity was approaching. The sea itself exhibited a very unusual appearance, its agitation resembling that of the waters of a lake which is covered with bubbles in a violent shower of rain. My surprise was still increased by the calmness and serenity of the weather; not a breeze stirred, not a cloud obscured the face of the sky, which might be supposed to produce these dreadful commotions. I therefore warned my companions, that the unusual phenomena which we observed, were the forerunners of an earthquake. Soon after we stood in for the shore, and landed at Tropæa; but we had scarcely arrived at the Jesuits college in that city, when a horrid sound, which resembled the rattling wheels of an infinite number of chariots, driven furiously along, stunned our ears. Soon after a terrible shaking of the earth began; the ground on which we stood seemed to vibrate, as if we were in the scale of a balance, which continued waving. The motion soon grew more violent; I could no longer keep my legs, but was thrown prostrate upon the ground. After some time had elapsed, when I had recovered from the consternation; and finding that I was unhurt amidst the general crash, I resolved to make the best of my way to a place of safety, and running as fast as I could, I reached the shore. I soon found the boat in which I had landed, as well as my companions; and leaving this scene of desolation, we prosecuted our voyage along the coast. Next day we arrived at Rochetta, where we landed, although the earth still continued in violent commotion. But we had scarcely reached the inn when we were again obliged to return to the boat. In about half an hour we saw the greatest part of the town, as well as the inn where we had stopped, levelled with the ground, and most of the inhabitants buried in its ruins. As we proceeded onward, we landed at Lopezium, which is a castle about half way between Tropæa and Euphemia, to which we were bound; and, here, wherever I looked, nothing but scenes of ruin and horror presented themselves. Towns and castles were levelled with the ground, and Stromboli at the distance of 60 miles threw out an immense body of flames, accompanied with a noise which could be distinctly heard. But our attention was quickly drawn from more remote to present danger. The rattling sound which immediately precedes an earthquake, again alarmed us; every moment it seemed to grow louder and louder, and to approach nearer the place on which we stood. A dreadful shaking of the earth now began, so that being unable to stand, my companions and I caught hold of whatever shrub was next to us, to support ourselves. After some time the violent commotion ceased, and we stood up, and proposed to prosecute our voyage to Euphemia, which lay within sight; but in the meantime, while we were preparing ourselves, I turned my eyes towards the city, but could see nothing but a thick, black cloud, which seemed to rest on the place. This appeared an extraordinary circumstance, as the sky all round was calm and serene. We waited till the cloud passed away, and then turning to look for the city, it was totally sunk, and where it formerly stood, nothing remained but a dismal and putrid lake."

202 In Sicily in 1693.

In the year 1693, an earthquake happened in Sicily, which not only shook the whole island, but also reached to Naples and Malta. Previous to the shock, a black cloud was seen hovering over the city of Catania, which was destroyed at this time. The sea began to be violently agitated; the shocks succeeded like the discharge of a great number of artillery; the motion of the earth was so violent, that no persons could keep their legs. Even those who lay on the ground were tossed from side to side, as on a rolling billow; high walls were razed from their foundations, and were thrown to the distance of several paces. Almost every building in the countries which it visited was thrown down; 54 cities and towns, besides a great number of villages, were either greatly damaged, or totally destroyed. Among those which we have already mentioned, was the city of Catania, one of the most ancient and flourishing in the kingdom. After the thick cloud which remained after the earthquake had dissipated, no remains of this magnificent city could be seen. Of 18,900 inhabitants, not fewer than 18,000 perished by this dreadful calamity.

203 In Jamaica in 1692.

The terrible earthquake which visited the island of Jamaica in 1692, affords us another example of almost the whole of the phenomena which were enumerated

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as the forerunners or attendants of earthquakes. It was on the 7th of June, in that year, that this dreadful calamity, which in two minutes totally destroyed the town of Port Royal, on the south side of Jamaica, and at that time the capital of the island, took place. The effect of the shock on the surface was immediately preceded by a hollow rattling noise, like that of thunder. The streets were heaved up like waves of the sea, and then instantly thrown down into deep pits. All the wells discharged their waters with prodigious agitation; the sea burst its bounds, and deluged a small part of the town which was not entirely overwhelmed. The fissures produced in the earth were so great, that one of the streets seemed twice as broad as formerly, and in some places the earth opened and closed again for some time. A great many of these openings were seen at once. In some of them, the houses and inhabitants, and every thing that was near, were swallowed up. Some persons were swallowed up in one of these chasms, and what will appear most extraordinary, and indeed almost incredible, were thrown out alive from another. Whole streets sunk in some, and from others an immense body of water was projected high into the air. Smells which were extremely offensive now succeeded; nothing but the distant noise of falling mountains was heard, and the sky, which before the shock was still and serene, assumed a dull red colour.

The effects of this earthquake were not limited to this spot. It was severely felt through the whole island, which in many places sustained very material damage. Indeed there were few houses which were not either injured or thrown down. In some places the inhabitants, houses, trees, and whole surface, were swallowed up in the same chasm; and what was formerly dry land was left a pool of water. The wells in almost every corner of the island, whatever was their depth, threw out their water with great violence. The rivers were either entirely stopped, or ceased to flow for 24 hours; and many of them formed to themselves new channels. At the distance of 12 miles from the sea, an immense body of water spouted out from a gap which was formed in the earth, and was projected to a great height in the air. Such was the violence of the shock, that many persons were thrown down on their faces, even in places where the surface of the ground remained unbroken. It was observed that the shock was most severely felt in the immediate vicinity of the mountains. Could this arise from the greater pressure, and consequently the greater resistance, or was it because the force which produced these terrible effects existed near them?

After the great shock which destroyed the town of Port Royal, the inhabitants who escaped went on board ships in the harbour, where many of them remained for two months, during which time the shocks were repeated, and were so frequent, that there were sometimes two or three in the course of an hour. These were still accompanied with the same rattling noise, like that of thunder, or like the rushing noise occasioned by a current of air in rapid motion. They were also attended with what are called *brimstone blasts*. These, it is probable, were sulphureous vapours which issued from the openings made by the earthquake. The atmosphere, however, seemed to be loaded with noisome vapours, for a very general sickness soon succeeded, which in a short time swept off not fewer than 3000 persons.

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204. At Lisbon in 1755.

But of all the earthquakes, the history of which is on record, that which happened at Lisbon, in the year 1755, was by far the most extensive in its effects, and, from its recent occurrence, will probably be deemed the most interesting. In the year 1750, several shocks of earthquakes had been sensibly felt. The four following years were remarkable for excessive drought. The springs which formerly yielded abundance of water, were totally dried up and lost; the winds which chiefly prevailed were from the north and north-east. During this period also there were slight tremors of the earth; the seasons in 1755, were unusually wet, and the summer, as the consequence of this, proved unusually cold. But for the space of 40 days before the earthquake happened, the sky was more clear and serene. On the last day of October the face of the sun was considerably obscured, and a general gloom prevailed over the atmosphere. The day following (the 1st of November) a thick fog arose, but it was soon dissipated by the heat of the sun. Not a breath of wind was stirring; the sea was perfectly calm, and the heat of the weather was equal to that of June or July in this country. At 35 minutes after nine in the morning, without any previous warning, excepting the rattling noise resembling that of distant thunder, the earthquake came on with short, quick vibrations, and shook the very foundation of the city, so that many of the houses instantly fell. A pause, which was indeed just perceptible, succeeded, and the motion changed. The houses were then tossed from side to side, like the motion of a waggon driven violently over rugged stones. It was this second shock which laid great part of the city in ruin, and, as might be expected, great numbers of the inhabitants were destroyed at the same time. The whole duration of the earthquake did not exceed six minutes. When it began, some persons in a boat, at the distance of a mile from the city, and in deep water, thought the boat had struck on a rock, in consequence of the motion which was communicated to it. At the same time they perceived the houses falling on both sides of the river. The bed of the Tagus was in many places raised to the very surface of the water; ships were driven from their anchors or moorings, and were tossed about with great violence; and the persons on board did not for some time know whether they were afloat or aground. A large new pier with several hundreds of people upon it, sunk to an unfathomable depth, and not one of the dead bodies was ever found. The bar of the river was at one time seen dry from side to side; but suddenly the sea came rolling in like a mountain, and in one part of the river the water rose in an instant to the extraordinary height of 50 feet. At noon another shock happened; the walls of some houses that remained were seen to open from top to bottom, near a foot wide, and were afterwards so exactly closed, that scarcely any mark of this injury remained.

205. The shock of this earthquake felt at Colares;

But what was the most singular circumstance attending this earthquake, was, the prodigious extent to which its effects reached. At Colares, 20 miles from Lisbon, and two miles from the sea, the weather was uncommonly warm for the season, on the last day of October. About four o'clock in the afternoon, a fog arose which,

proceeding

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proceeding from the sea, covered the valleys. This was an unusual occurrence at that season of the year; but soon after the wind shifting, the fog returned to the sea, collected over its surface, and became very thick and dark; and as the fog dispersed, the sea was violently agitated, and with great noise. On the first of November, at the dawn of day, the sky was fair and serene; about nine o'clock the sun was overclouded, and became dim. Half an hour after, the rattling noise like that of chariots was heard; and this soon increased to such a degree, that it resembled the explosions of the largest artillery. The shock of an earthquake was immediately felt, and was quickly succeeded by a second and a third. In these shocks it was observed, that the walls of buildings moved from east to west. From some of the mountains flames were seen issuing, somewhat resembling the kindling of charcoal accompanied with a great deal of thick black smoke. The smoke which arose from one mountain was at the same time accompanied with noise, which increased with the quantity of smoke. When the place from which the smoke issued was afterwards examined, no signs of fire could be perceived.

5 At Oporto.

At Oporto, near the mouth of the river Douro, the earthquake began at 40 minutes past nine. The sky was quite serene when the hollow rattling noise was heard, and it was immediately attended with a commotion of the earth. In the space of a minute or two, the river rose and fell five or six feet, and continued this motion for four hours. In some places it seemed to open, and discharge great quantities of air. The sea was also violently agitated, and indeed the agitation was so great, to the distance of a league beyond the bar, that it was supposed the discharge of air from that place must also have been very considerable.

Destruction at St Ubes.

St Ubes, a sea-port town twenty miles south of Lisbon, was entirely swallowed up by the repeated shocks of this earthquake, and the immense surf of the sea which was produced. Large masses of rock were detached from the promontory at the extremity of the town. This promontory consists of a chain of mountains composed of a very hard stone.

Felt in Spain.

The same earthquake was felt in almost every part of Spain. The only places which escaped from its effects were the provinces of Arragon, Catalonia, and Valencia. At Ayamonte, which is near the place where the Guadiana falls into the bay of Cadiz, the earthquake was not felt till a little before ten o'clock. It was here also preceded by the hollow rattling noise. The shocks continued with intervals, for 14 or 15 minutes, and did very considerable damage. Scarcely half an hour had elapsed from the time that the commotion first began, when the sea, the river, and canals, rose violently over their banks, and laid every place near them under water. The sea rolled in in huge mountains, and carried every thing before it.

The earthquake began at Cadiz some minutes after nine in the morning, and lasted about five minutes. The water in the cisterns under ground was so much agitated, that it rose in the form of froth. About ten minutes after eleven, a huge wave was seen coming from the sea, at the distance of eight miles, which was supposed not to be less than 60 feet high, and burst in upon the city. The water returned with the same violence with which it approached, and places which were deep at low water were left quite dry. Similar waves continued, but gradually lessening, till the evening.

The earthquake was not felt at Gibraltar till after ten o'clock. There it began with a tremulous motion of the earth, which continued for about half a minute. A violent shock then followed; the tremendous motion again commenced, and continued for five or six seconds, and then succeeded a second shock, but less violent than the first. The whole time did not exceed two minutes; the earth had an undulating motion; some of the guns on the batteries were seen to rise, and others to sink. Many people, seized with sickness and giddiness, fell down. Some who were walking or riding, felt no shock, but were attacked with sickness. The sea had an extraordinary flux and reflux; it ebbed and flowed every 15 minutes; it rose six feet, and then fell suddenly so low, that a great many fish and small boats were left on the shore.

The shock was felt at Madrid nearly at the same time as at Gibraltar. It continued for six minutes, and the same sickness and giddiness prevailed. It was not felt by those who walked smartly, or who were in carriages, and no accident happened excepting two persons who were killed by the fall of a stone cross from the porch of a church.

Malaga, a sea-port town on the Mediterranean, experienced a violent shock; the bells were set a ringing in the steeples, and the water of the wells overflowed, and as suddenly retired. St Lucar, at the mouth of the Guadalquiver, suffered much from a similar shock, as well as from an inundation of the sea, which broke in, and did great damage. St Seville, 16 leagues above this, a number of houses was thrown down; the celebrated tower of the cathedral, called *La Giralda*, opened in the four sides; the waters were thrown into violent agitation, and the vessels in the river were driven on shore.

209 In Africa.

In Africa this earthquake was felt nearly as severely as in Europe. Great part of the city of Algiers was destroyed. This happened about ten in the morning. About the same time at Arzilla, a town in the kingdom of Fez, the sea suddenly rose with such impetuosity, that it lifted up a vessel in the bay, and forced it on shore with such violence that it was broken to pieces. A boat was also found within land, at the distance of two musket shots from the sea. At Fez and Mequinez, many houses were thrown down, and numbers of persons were buried in the ruins.

Many people were destroyed at Morocco by the falling of houses. Eight leagues from the city the earth opened, and swallowed up a village with all its inhabitants, to the number of 8,000 or 10,000, as well as all their cattle. Soon after the earth closed, and they were seen no more. The town of Sallee also suffered greatly; a third part of the houses were thrown down; the waters rushed into the streets with great violence, and when they retired, they left behind them a large quantity of fish. The earthquake began at Tangier at ten in the morning; its whole duration was about ten or twelve minutes. The sea came up to the walls with great violence, and retired immediately with the same rapidity, leaving behind a great quantity of fish. This agitation of the water was repeated no less than 18 times, and continued till about six o'clock in the evening. It began at the same time at Tetuan, but its duration

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ration was only about seven or eight minutes. Three of the shocks were so violent as to excite great apprehensions that the city would be destroyed. Similar effects were produced by the same earthquake at different places along the African shore of the Mediterranean.

210 In Madeira and the West Indies

At the town of Funchal in Madeira, the first shock of this earthquake was felt at 38 minutes past nine. It was preceded by the rattling noise, which seemed to be produced in the air; the shock, it was supposed, continued for more than a minute; the earth moved with a vibratory, undulating motion, and some of the vibrations increased greatly in force. The noise in the air which accompanied the shocks, lasted some seconds after the motion of the earth had ceased. At three quarters past eleven, the day being calm and serene, the sea retired suddenly, then, without the least noise, rose with a great swell, overflowed the shore, and entered the city. It rose 15 feet perpendicular above high-water mark. Having thus fluctuated four or five times, it at last subsided, and resumed its former stillness. In the northern part of the island, the inundation was still more violent. It first retired to the distance of 100 paces, and suddenly returning, overflowed the shore, broke down walls of magazines and storehouses, and left behind it great quantities of fish in the streets of a village. At this place the sea rose only once beyond the high-water mark, although it continued to fluctuate much longer before it entirely subsided than at Funchal.

Such were the effects of this earthquake, in those places where it was accompanied with considerable damage. It was, however, perceptibly felt to a great distance in every direction, either by a slight motion of the earth, or by the agitation of the waters. At the island of Antigua the sea rose to such a height as had never been before known, and afterwards the water at the wharfs which used to be six feet deep, was not more than two inches. About two in the afternoon, the sea ebbed and flowed at Barbadoes in a very unusual manner. It overflowed the wharfs, and rushed into the streets. This flux and reflux continued till 10 at night.

211 In France.

Shocks were distinctly felt in different parts of France, as at Bayonne, Bourdeaux, and Lyons, The waters were also observed to be agitated in different places, as at Angouleme, and Havre de Grace, but with a less degree of violence than some which have been mentioned. At Angouleme, a subterraneous noise like thunder was heard, and soon after a torrent of water, mixed with red sand, was discharged from an opening in the earth. Most of the springs in the neighbourhood sunk, and continued dry for some time.

212 In Germany.

The effects of this earthquake were also very perceptible in many places of Germany. Throughout the duchy of Holstein, the waters were greatly agitated, particularly the Elbe and Trave. The water of a lake, called *Libsec*, in Brandenburg, ebbed and flowed six times in half an hour, and although the weather was then perfectly calm, this motion was accompanied with a great noise. A similar agitation took place in the waters of the lakes called *Mupelgast* and *Netzo*, but here there was also emitted a most offensive smell.

The sea was greatly agitated round the island of Corsica, and many of the rivers of the island overflowed their banks. The same earthquake was felt in the city of Milan in Italy, and its neighbourhood. Turin in Savoy experienced a very smart shock.

21[?] In Switzerland.

Many of the rivers of Switzerland became all at once muddy, although there had been no rain. The lake of Neufchatel rose to the height of two feet above its usual level, and continued at this height for a few hours. The waters of the lake of Zurich were also greatly agitated.

21[?] In Holland.

The commotion of the waters in Holland was still more remarkable. In the afternoon of the 1st of November, the waters of the Rhine at Alphen, between Leyden and Woerden, were so violently agitated, that the buoys were broken from their chains, large vessels parted from their cables, and smaller ones were thrown upon the dry land. At 11 in the forenoon at Amsterdam, when the air was perfectly calm, the waters in the canals were thrown into great commotion, so that boats broke loose from their moorings, chandeliers were observed to vibrate in the churches, although it is said no motion of the earth was perceptible. In the forenoon, at Haarlem, not only the water in the rivers, canals, &c. but, it is asserted, smaller quantities of fluids contained in vessels, were greatly agitated, and sometimes dashed over the sides of the vessels. This continued for about four minutes. Between 10 and 11 in the forenoon, in some of the canals at Leyden, the waters rose suddenly, and produced very perceptible undulations.

21[?] In Norway, &c.

The effects of this earthquake extended as far north as Norway and Sweden: many of the rivers and lakes in Norway were greatly agitated; shocks were felt in several of the provinces in Sweden, and commotions of the waters, with the rivers and lakes, especially in Dalecarlia, were observed. The river Dala suddenly overflowed its banks, and as suddenly retired; and at the same time, a lake which is a league distant from it, bubbled up with great violence. Several smart shocks were felt at Fahlun, a town in Dalecarlia.

21[?] In Britain.

In many places of Great Britain and Ireland, the agitation of the waters was very perceptible. At Eaton bridge in Kent, near a pond of an acre in extent, some persons heard a sudden noise, which they supposed was occasioned by something falling into the pond, for it was then a dead calm, and ran to the spot, where they saw the pond open in the middle, while the water dashed over a perpendicular bank two feet high. This motion was repeated several times, and still accompanied with a great noise.

At Cobham in Surry, between 10 and 11 o'clock A. M. a person was watering a horse at a pond, the waters of which were derived from springs. At the moment the animal was drinking, the water retired from his mouth, and left the bottom of the pond dry. It then returned with great violence, and when it retired, its progress was towards the south. About the same time at Bushbridge, in the same county, while the weather was remarkably calm, the waters of a canal 700 feet long and 58 broad, were greatly agitated, and this was accompanied with an unusual noise. The waters rose between two and three feet above the usual level, in the form of a heap or ridge, extending 30 yards in length. This ridge then heeled towards the north side, and flowed with great impetuosity over the grass walk; it then returned to the canal, again heaped up in the middle, and then heeled to the south side with

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with still greater violence, flowing over the grass walk, and leaving several feet at the bottom of the canal on the north side perfectly dry. These motions continued for 15 minutes, after which the waters resumed their former tranquillity. During the agitation of the waters, the sand and mud at the bottom were thrown up, and mixed with them.

In Suffolk, the water of a pond at Dunstal rose gradually for several minutes in the form of a pyramid, and then fell down like a water-spout. In other ponds in the same neighbourhood, the waters of which were less agitated, there was a smooth flux and reflux from the one extremity to the other.

At Earsycourt in Berkshire, about 11 o'clock, a person standing near a fish pond, felt a violent trembling of the earth, which continued for about a minute. He observed immediately after, the water move from the south to the north end of the pond, leaving the bottom of the south end quite dry, to the extent of six feet. It then returned, flowed at the south end, rose three feet up the bank, and immediately after returned to the north bank, where it rose to the same height. Between the flux and reflux the waters formed a ridge in the middle of the pond, 20 inches higher than the level on each side, and boiled up with great violence.

Similar phenomena were observed about half after ten, near Durham. A person was alarmed with a sudden rushing noise, which seemed to proceed from a pond. The water rose gradually up without any fluctuating motion, stood some inches higher than the usual level; it then subsided and swelled again, and continued in this manner rising and falling for the space of six or seven minutes, rising four or five times in a minute.

The effects of this earthquake in Derbyshire excited considerable alarm. At Barlborough, between 11 and 12 o'clock, in a boat-house on the west side of a large body of water, called *Pibley dam*, which is supposed to cover not less than 30 acres of land, there was heard a sudden and terrible noise; a swell of water proceeding from the south, rose two feet on the slope dam head at the north end. It then subsided, but immediately returned. The water continued thus agitated for 45 minutes, but became gradually less violent. At Eyam bridge in the Peak, an overseer of the lead mines, sitting in his room about 11 o'clock, felt a sudden shock, by which the chair on which he sat was suddenly raised, and some pieces of plaster were broken off from the sides of the room. The commotion was so great that he thought the engine shaft had fallen together, and he ran out to see what was the matter, and found every thing in safety. Some miners employed at the time in a drift 120 yards deep, were greatly alarmed first with one shock, and then with a second, which seemed to be so violent as to make the rocks grind upon one another. Three other shocks succeeded the two first at intervals of a few minutes, and became gradually weaker.

A little after 10 o'clock in the morning, the water in a moat which surrounds Shireburn castle in Oxfordshire, exhibited a very unusual appearance. A thick fog prevailed, the air was perfectly still, and the surface of the water quite smooth. At one corner it was observed to flow towards the shore, and then again to retire; and this flux and reflux continued for some time quite regular. Every flux began slowly; but increased in its velocity till near its full height, when it rushed with great impetuosity; and having remained for a short time stationary, it then retired, at first slowly, but at last it sunk with great rapidity. What will appear most singular in this commotion of the water is, that it was limited to one part of the moat. At a different corner about 25 yards distant no motion could be perceived. But in that part of the moat directly opposite to the place where the motion of the water was first observed, the water rose towards the shore at the same time as at the other side. In a pond at a little distance the waters were agitated in a similar manner, but the risings and sinkings took place at different times from those in the moat.

On the evening of the same day, about three quarters after six, and about the time of two hours ebb of the tide, at White rock in Glamorganshire, a great body of water rushed up, accompanied with great noise. It was in such quantity that it floated two vessels not less than 200 tons burden each, drove them from their moorings, and carried them across the river. The whole length of time of the rise and fall of this body of water did not exceed 10 minutes, so that it seemed to have burst from the earth at the spot where it appeared. It seems singular, if the account of it be correct, that on this spot the effects of the earthquake should be felt at the distance of seven or eight hours from the time it was felt in other parts of the island.

217 In Scotland.

The waters of the lakes in Scotland were also greatly agitated from the same cause. Half an hour after nine in the morning, without the least breath of wind, the water in Loch Lomond rose suddenly and violently against its banks. It immediately fell very low, again returned to the shore, and in five minutes rose as high as at first. This commotion continued till 15 minutes after 10, with an alternate flux and reflux every five minutes. From this time, till 11 o'clock, the height to which the water rose gradually diminished, till it resumed its former tranquillity. But each flux and reflux continued for a period of five minutes as at first. Here the violence of the shock was such, that a large stone lying at some distance from the shore in shallow water, was moved from its place and carried to dry land, leaving a deep furrow in the ground along which it had moved.

About the same time the waters of Loch Ness in the north of Scotland exhibited also a very unusual agitation. About ten o'clock the river Oich, which falls into the head of the loch, swelled very much, and ran upwards from the loch with a high wave two or three feet above its usual level. The motion of the wave was in a direction contrary to that of the wind, and it proceeded with great rapidity up the river for the space of 200 yards, broke on a shallow, and overflowed the banks. It then returned gently to the loch. This ebbing and flowing continued for about an hour, the height of the waves gradually diminishing, till, about 11 o'clock, a wave higher than any of the former broke with such violence on the bank on the side of the river, that it ran upwards of 30 feet from the bank.

218 In Ireland.

Between two and three o'clock in the afternoon, at Kinsale in Ireland, when the weather was perfectly calm and the tide nearly full, a great body of water suddenly burst into the harbour, and with such violence,

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lence, that it broke the cables of two vessels, each moored with two anchors, and of several boats which lay near the town. The vessels were whirled round several times by an eddy formed in the water, and then hurried back again with the same rapidity as before. These motions were repeated different times; and while the current rushed up along one side of the harbour, it ran down with the same violence along the other. The muddy bottom of the harbour was greatly altered; the mud was removed from some places and deposited in others. At one place the height of the water, where it was measured, was found to be five feet and a half; in other places it is said to have been much higher, particularly where it flowed into the market-place with such rapidity, that many persons had not time to escape, but were immersed, knee deep, in the water. These commotions extended several miles up the river, and were most perceptible in shallow places. The alternate elevation and depression of the water continued about ten minutes, when the tide returned to its usual level. In the evening, between six and seven, the water rose again, but with less violence than before, and continued to ebb and flow till three next morning. The rise of the waters was not at first gradual, but, accompanied with a hollow noise, rose six or seven feet in a minute, and rushed in like a deluge, after which it as suddenly subsided. The waters, too, became thick and muddy, emitting at the same time a most offensive smell. Similar agitations of the waters were observed all along the coast to the westward of Kinsale.

219 Effects at sea.

Such were the phenomena of this earthquake, as they were observed on land in the different places which have been mentioned. Its effects were also severely felt at sea. A frigate off St Lucar received so violent a shock, that it was supposed she had struck the ground. Another vessel in N. Lat. 36. 24. between nine and ten in the morning, was so much shaken and strained as if she had struck upon a rock. The seams of the deck opened, and the compass was overturned. The sensation experienced by some persons on board of another vessel, which was then in N. Lat. 25°. W. Long. 40°. were such as if she had been suddenly raised up and suspended by a rope. One person looking out at the cabin window, thought he saw land about a mile distant; but when he reached the deck, no land was to be seen. A strong current was observed crossing the ship's way to leeward. The current returned in about a minute with great violence; and, at the distance of about a league, three craggy pointed rocks were seen throwing up water of various colours, and seemingly resembling fire. This appearance terminated in a thick black cloud, which arose heavily in the atmosphere. Between nine and ten in the morning another ship, 40 leagues off St Vincent, received so violent a shock, that the men on deck were thrown a foot and a half above its surface, and the anchors, although they were lashed down, bounced up. Immediately after the ship sunk in the water so low as the main chains. On heaving the lead a great depth of water was found, and the line was of a yellow colour, and gave out the smell of sulphur. The first shock was the most violent; but smaller ones were repeated for 24 hours.

220 On springs.

The effects of this earthquake on springs were very remarkable. On the afternoon of the 31st of October, the water of a fountain at Colares was observed to be greatly diminished. On the morning of the 1st of November, the day on which the earthquake happened, it became thick and muddy, but afterwards recovered its usual quantity and limpidity. In some places springs appeared where there had been formerly no water, and continued afterwards to flow. At Varge, on the river Macaas, many springs of water burst forth at the time of the earthquake, and some threw up their waters mixed with sand of various colours, to the height of 18 or 20 feet. In Barbary, a stream of water, which was as red as blood, burst forth from a mountain, which was split in two. At Tangier all the fountains were dried up during the whole of the day on which the earthquake happened. The mineral waters of Toplitz, a village in Bohemia, which have been celebrated since the year 1672, experienced a very remarkable change. The principal hot spring had continued to flow from the time it was discovered, of the same temperature and the same in quantity. On the morning of the earthquake, between 11 and 12 o'clock, the waters of this spring increased so much in quantity, that all the baths ran over in the space of half an hour. A short time before the water increased, it flowed from the spring thick and muddy; and then having entirely stopped for about a minute, it burst out with great violence, carrying before it a great quantity of reddish ochre. It afterwards became limpid, and flowed as formerly; but in larger quantity, and of a higher temperature. At Angouleme in France the earth opened in one place, and discharged a great body of water, which was mixed with reddish sand. Most of the springs in the neighbourhood sunk so low, that for some time it was supposed they had become quite dry.

Such were the extraordinary effects of this terrible earthquake, which extended over a space not less than four millions of square miles. Other earthquakes, although of more limited extent, have produced effects not less destructive, and particularly some of the earthquakes which have visited Italy and Sicily in modern times; accounts of which have been drawn up with accuracy and attention. Some of these we shall now detail.

221 Earthquake in Calabria in 1783.

One of the most calamitous earthquakes was that which befel Calabria in the year 1783. Of this earthquake Sir William Hamilton, who, soon after the earthquake happened, visited the scenes of desolation which it left behind, has drawn up a particular account. He observes, that "if on a map of Italy, and with your compass on the scale of Italian miles, you were to measure off 22, and then fixing the central point on the city of Oppido, which seemed to be the spot where the earthquake had exerted its greatest force, form a circle, the radius of which will be 22 miles, you will then include all the towns, villages, &c. that have been utterly ruined, and the spots where the greatest mortality happened, and where there have been the most visible alterations on the face of the earth. Then extend your compass in the same scale to 72 miles, preserving the same centre, and form another circle, you will include the whole country that has any mark of having been affected by the earthquake. A gradation was plainly observed in the damage done to the

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This earthquake, it has been remarked, differed very considerably from others in one circumstance, which was this. Where it happened that two towns were situated at the same distance from the centre, one of which was placed on a hill, and the other on a plain, it was found that the town on the lowest situation always sustained the greatest damage from the shocks of the earthquakes which are alluded to above.

That part of Calabria which most severely felt this dreadful calamity, lies between the 38th and 39th degrees of latitude, and the force of the earthquakes extended from the foot of the Appenines called Monte Dijo, Monte Sacro, and Monte Caulene, as far to the westward as the Tyrrhene sea. By the shock of the 5th of February, every town, village, and farm-house nearest to the mountains, whether situated on some part of the elevated ground or on the plain, was left a heap of ruins. In proportion to the distance from the centre, as has been already hinted, the damage sustained was more or less considerable. But even the more distant towns and villages suffered greatly from the shocks which happened on the 7th, 26th, and 28th of February, and on the 1st of March. From the time the first shock came on, the earth continued in a constant tremor; the shocks were felt with different degrees of force in different parts of the provinces which were the scene of this terrible calamity; and the motion was either in a whirling direction, as in a vortex, or horizontal, or pulsatory, the beatings proceeding from the bottom upwards. The apprehensions and alarms of the miserable inhabitants were terribly increased by this variety of changing motions, dreading that every moment the earth would open under their feet and swallow them up. That part of Calabria which suffered from this earthquake, was also drenched with long continued and heavy rains, accompanied with frequent and furious squalls of wind. These rains prevailed particularly on the western side, where many fissures had appeared in the mountains. Some mountains had been lowered greatly, and others had been entirely swallowed up. The roads were rendered impassable by the deep chasms which were left by the shock; valleys were filled up by the parts of mountains which were split asunder; the course of rivers was changed; springs were dried up, and new springs burst out where none existed before.

At Laureana in Farther Calabria, two houses, surrounded with extensive plantations of olive and mulberry trees, situated in a valley, were removed by the force of the earthquake, with all their trees, and carried to the distance of a mile; and on the spot where they formerly stood, hot water burst from the earth, and was projected to a considerable height into the air. The water was mixed with sand of a reddish colour. Some countrymen and shepherds, who were employed in rural affairs near this spot, were swallowed up, with their teams of oxen, and their whole flocks of goats and sheep. The number of inhabitants who lost their lives in this calamity, exceeded, according to some calculations, 32,000; but it is supposed by others, that, including strangers, the number was not less than 40,000.

Earthquakes and Volcanoes. The inhabitants of the town of Scilla, on the first shock of the earthquake on the 5th of February, had fled along with their prince to the sea shore for safety, and remained either on the strand or in boats near the shore. In the night time a tremendous wave overflowed the land to the distance of three miles from the shore, and, in its return, swept off near 3000 of the inhabitants, among whom was the prince. This water was said by some to have been boiling hot, so that many of the people were supposed to have been scalded with it. A mountain, it is asserted, of 500 palms in height, and 1300 palms in circumference at its base, was detached from the place where it stood, and carried to the distance of four miles. It was about the same time that the hill on which the town of Oppido stood, and which extended three miles in length, was split in two, and filled up on each side the bed of a river. Two great lakes were formed by the current of the rivers being stopped; and, as they increased in extent, infected the air with their putrid and noisome exhalations.

Sir William Hamilton, who was then resident at Naples as ambassador from Britain, was indefatigable in obtaining every kind of information with regard to the effects of this earthquake. With this view he made an extensive tour over those parts of the country which had been visited by this calamity. Some of the accounts which were first published seem to have been somewhat exaggerated, either from the love of the marvellous in those who framed them, or from the excessive alarms of the surviving sufferers. On the 2d of May following Sir William landed on the coast of Hither Calabria. The effects of the earthquake were first perceived at Cedraro. The inhabitants had quitted their houses, but it did not appear that the town had sustained any material damage. Most of the inhabitants of St Lucido were then living in barracks, and the baron's palace, as well as the church steeple, had suffered greatly. He afterwards landed at the town of Pizzo in Farther Calabria. This town stood on volcanic tufa. It sustained great injury from the shock of the 5th February, but was completely destroyed by that of the 28th. Here he was informed, that Stromboli, a volcanic mountain which is nearly opposite, and in full view, but 50 miles distant, had ejected much less matter, and had thrown up less smoke, during the time of the earthquakes, than it had done for many years before. Even at this time slight shocks of earthquakes were occasionally felt. One indeed happened the same night. The boat in which he slept received a smart shock, and seemed to be lifted out of the water; but this shock was unaccompanied with noise.

The town of Monteleone is situated on a hill which overlooks some fine rich plains and the sea below. These plains, formerly covered with numerous towns and villages, now exhibited a gloomy scene of utter desolation. The town of Monteleone itself had not suffered materially from the first shock on the 5th of February; but it was considerably damaged by some of those which took place afterwards. It was generally observed, that the shocks of the earthquake came on with a rattling noise, which seemed to proceed from the westward. They usually began with a horizontal motion, and terminated with a whirling motion, during which most of the buildings in the province were thrown down. It was generally observed too, that previous to a shock the clouds

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clouds seemed to be unusually still and motionless, and that a shock quickly succeeded a heavy shower of rain.

Approaching the plain, it was observed, according to the general remark made above, that the towns and villages were more or less desolated in proportion to their vicinity to the plain. Of the town of Mileto, which stood in a bottom, not a house remained. Soriano and the noble Dominican convent presented a heap of ruins. According to the same general remark, all the buildings which stood upon the high grounds, the soil of which is a gritty sandstone, sustained less damage than those situated in the plain, for the latter were universally thrown down. The soil of the plain is a sandy clay of various colours, and full of sea shells. It is frequently intersected by rivers and torrents which have formed wide and deep ravines. Passing through St Pietro, a town in ruins, Sicily was seen and the summit of Mount Ætna, which at this time threw out a considerable quantity of smoke. In a swampy plain through which he passed, Sir William examined a number of small holes in the earth, of the shape of an inverted cone. These holes were covered with sand as well as the surrounding soil. During the earthquake of the 5th of February, water mixed with sand spouted up to a considerable height from each of these openings. The river, it was observed, before these fountains burst out, was dried up; but soon after the waters returned, and overflowed their banks. It appeared from more extensive observation, that the same thing had uniformly happened to all the other rivers in the plain during the shock of the 5th of February. This has been ascribed to the first impulse of the earthquake proceeding from the bottom upwards, and this seemed to be the general opinion. The surface of the plain then rising suddenly, the rivers which are shallow naturally disappeared; and the plain returning with violence to its former level, the rivers returned and overflowed from the sudden depression of the boggy grounds, which would naturally force out the water under their surface.

The town of Rosarno, and the duke of Monteleone's palace, was a heap of ruins; six feet high of the walls only remained. It was somewhat singular, that the only building which escaped uninjured was the public jail. At Laureana Sir William ascertained the truth of the circumstance of the two tenements which were said to have been removed from their situations. These stood in a valley surrounded with high grounds. In the same valley were observed hollows in the form of inverted cones similar to those which he had formerly examined. Between this place and the town of Polistene he did not see a single house, after travelling four days through a rich and beautiful country. Every thing presented the most indescribable misery: the violence of the earthquake was so great that all the inhabitants were buried in an instant alive or dead in the ruins of their houses. This town was situated between two rivers that were occasionally subject to overflow their banks. Of six thousand inhabitants, more than two thousand lost their lives by the shock on the 5th of February.

The princess Gerace Grimaldi, with four thousand of her subjects, perished at Casal Nuova on the same day; some persons who were dug alive out of the ruins observed, that they felt their houses fairly lifted up without any previous warning. An inhabitant of this town, being at that moment on a hill which overlooked the plain, when he felt the shock turned round towards the town, but he could see nothing excepting a thick white cloud of dust. So completely was this town destroyed, that no vestige of house or street remained; all lay in the same confused heap of ruins. Other towns had suffered in the same manner, and now exhibited the same scene of desolation.

Terra Nuova suffered severely from the same earthquake. It is situated between two rivers which had formed deep and wide ravines in their course; one of these was not less than 500 feet deep, and three quarters of a mile broad. In consequence of the great depth of this ravine, and the violent motion of the earth, two large masses of the soil on which a great part of the town, consisting of some hundred houses, had been thrown into the ravine at the distance of half a mile from the place where they formerly stood. Many of the inhabitants who had been carried along with their houses, were dug out of the ruins alive, and even some of them escaped unhurt. Of 1600 inhabitants, 400 only remained alive. In other places in the same neighbourhood, great tracts of land had been removed and carried to a considerable distance, with all their plantations and crops, which continued to grow and thrive in their new situation as well as formerly. The river here disappeared at the moment of the earthquake; but soon after returned, and covered the bottom of the ravine to the depth of three feet. This water was observed to be salt like that of the sea.

The whole town of Molochi di Sotto had been thrown into the ravine, and a vineyard of many acres lay near it in an inclined situation, but had not suffered any other injury. In several parts of the plain, the soil, with all its trees and crops of corn, to the extent of many acres, had sunk eight and ten feet below the level of the plain; and in other places it had risen the same height. The soil of this plain, it is to be observed, is composed of clay mixed with sand, which readily assumes any form.

22[illegible] Destruction of Oppido.

Sir William next proceeded to Oppido, which, it will be recollected, was considered as the central point on which the greatest force of the earthquake was exerted. This city stands on a mountain of gritstone of a reddish colour. It is surrounded by two rivers, which run in a deep ravine. It had been reported, that the mountain on which the city stands, had been split in two, and stopped up the course of the rivers; but it appeared on examination, that huge masses of the plain on the edge of the ravine, had been detached into it, and had so far filled it up, as to stop the course of the rivers, the waters of which were collecting, and forming lakes to a great extent. Part of the rock, it was found, on which the city stood, was separated, and with several houses upon it, was thrown into the ravine. Great tracts of land, with plantations of vines and olives, were transported from one side of the ravine to the other, to a distance exceeding half a mile.

"Having walked, (says Sir William), over the ruins of Oppido, I descended into the ravine, and examined carefully the whole of it. Here I saw, indeed, the wonderful force of the earthquake, which has produced exactly the same effects as those described in the ravine at Terra Nuova, but on a scale infinitely greater. The enormous masses of the plain detached from each side of

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of the ravine, lie sometimes in confused heaps, forming real mountains, and having stopped the course of two rivers (one of which is very considerable), great lakes are already formed; and if not assisted by nature or art so as to give the rivers their due course, must infallibly be the cause of a general infection in the neighbourhood. Sometimes I met with a detached piece of the surface of the plain (of many acres in extent) with the large oaks and olive trees, with corn or lupins under them, growing as well and in as good order at the bottom of the ravine, as their companions from whence they were separated do on their native soil, at least 500 feet higher, and at the distance of about three quarters of a mile. I met with whole vineyards in the same order in the bottom, that had likewise taken the same journey. As the banks of the ravine from whence these pieces came are now bare and perpendicular, I perceived that the upper soil was a reddish earth, and the under one a sandy white clay, very compact, and like a soft stone. The impulse these huge masses received, either from the violent motion of the earth alone, or that assisted with the additional one of the volcanic exhalations set at liberty, seems to have acted with greater force on the lower and more compact stratum than on the upper cultivated crust: for I constantly observed, where these cultivated lands lay, the under stratum of compact clay had been driven some hundred yards farther, and lay in confused blocks; and, as I observed, many of these blocks were in a cubical form. The under soil, having had a greater impulse, and leaving the upper in its flight, naturally accounts for the order in which the trees, vineyards, and vegetation fell, and remain at present in the bottom of the ravine.

"In another part of the bottom of the ravine there is a mountain composed of the same clay soil, and which was probably a piece of the plain detached by an earthquake at some former period: it is about 250 feet high, and 400 feet diameter at its basis. This mountain, as is well attested, has travelled down the ravine near four miles; having been put in motion by the earthquake of the 5th of February. The abundance of rain which fell at that time, the great weight of the fresh detached pieces of the plain which I saw heaped up at the back of it, the nature of the soil of which it is composed, and particularly its situation on a declivity, account well for this phenomenon; whereas the reports which came to Naples of a mountain having leaped four miles, had rather the appearance of a miracle. I found some single timber trees also with a lump of their native soil at their roots, standing upright in the bottom of the ravine, and which had been detached from the bottom of the plain above mentioned. I observed also, that many confused heaps of the loose soil, detached by the earthquake from the plains on each side of the ravine, had actually run like a volcanic lava (having probably been assisted by the heavy rain, and produced many effects much resembling those of lava during their course down a great part of the ravine. At Santa Christina, near Oppido, the like phenomena have been exhibited, and the great force of the earthquake of the 5th of February seems to have been exerted on these parts, and at Casal Nuova, and Terra Nuova.

The next places which were visited were the towns of Seminara and Palmi. Palmi is nearer the sea, and had suffered most; not fewer than 1400 of the inhabitants having been destroyed. In the course of his tour in this part of the country, he was informed that the sea was observed to be hot, and fire was seen issuing from the earth.

At Reggio, although the shock had been much less violent than in other places, no house was yet habitable. During the earthquakes which visited this place in 1770 and 1780, near 17,000 inhabitants lived for several months encamped in the fields, or in barracks.

Having examined the different places on the Calabrian coast, which had suffered from this terrible earthquake, Sir William Hamilton sailed for Messina in Sicily, to be informed of its effects there. He found that the shock had been very violent, but far less so than on the opposite shores. Many of the houses, even in the lower part of the town, were standing, and some of them had sustained little damage; but in the more elevated situations the shocks seemed to have had scarcely any effect. This still corresponds with the general remark, which was already made. A striking instance of this appeared in two convents, which are situated on elevated places, and had suffered nothing from the earthquakes which had afflicted the country for four months. It was said that fire had been seen issuing from fissures of the earth near the shore. The shock of the earthquake on the 5th of February, seemed to proceed from the bottom upwards; but the succeeding shocks came on with a horizontal or whirling motion.

A remarkable circumstance with regard to fish, was taken notice of at Messina, and indeed the same thing was observed along the coast of Calabria, where the effects of the earthquake had been most severe. A small fish, somewhat larger than the English white bait, but resembling it, and which usually lies at the bottom of the sea, buried in sand, had remained for several months after the commencement of the earthquakes, near the surface, and was taken in great abundance to be the common food of poor people. Before the earthquake, this fish was extremely rare, and was considered as a great delicacy. After the earthquake, indeed, it was observed, that fish of all kinds were found in greater abundance.

These earthquakes, of which we have now given so detailed an account, continued for many months afterwards; tremulous motions of the earth continued to be felt, and they were not perfectly settled even in the year 1784.

223 Earthquakes in Peru.

The southern continent of America is often visited by earthquakes. In the year 1797, Peru was afflicted with this dreadful calamity, which perhaps in the extent of surface which experienced the dreadful shock, exceeds that of any earthquake, the history of which is on record. The following is a short account of this earthquake by M. Cavanilles. "In the midst, (says he), of the most profound calm, there is frequently heard a dreadful bellowing noise, the forerunner of earthquakes, to which this part of the world is often exposed. After the year 1791, this noise was frequently heard in the neighbourhood of the mountain of Tunguragua. Antonio Pineda and Née, the two naturalists employed in the expedition round the world, when examining the declivity of this volcano, the lava of which had been hardened more by the internal fire than

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than by the ardour of the sun, were struck with terror by the horrible sound which they heard, and the heat which they experienced. Pineda, that valuable member of society, whose premature death is still deplored by the friends of science, foretold that a terrible eruption was preparing in the mountain of Tunguragua; and his conjectures were confirmed by the event. On the 4th of February 1797, at three quarters past seven in the morning, the summit of the volcano was more free from vapours than usual; the interior part of the mountain was agitated by frequent shocks, and the adjacent chains burst in such a manner, that in the space of four minutes an immense tract of country was convulsed by an undulating movement. Never did history relate the effects of an earthquake so extraordinary, and never did any phenomenon of nature produce more misfortunes, or destroy a greater number of human beings. A number of towns and villages were destroyed in a moment: some of them, such as Riobamba, Quero, Pelileo, Patate, Pillaro, were buried under the ruins of the neighbouring mountains; and others in the jurisdictions of Harnbata, Latacunga, Guaranda, Riobamba, and Alausi, were entirely overthrown. Some sustained prodigious loss by the gulfs which were formed, and by the reflux of rivers intercepted in their course by mounds of earth; and others, though in part saved, were in such a shattered state as to threaten their total ruin. The number of persons who perished during the first and succeeding shocks is estimated at 16,000. At ten o'clock in the morning, and four in the afternoon, the same day, (February 4.) after a dreadful noise, the earth was again agitated with great violence, and it did not cease to shake, though faintly, for the whole months of February and March; but, at three quarters past two in the morning of the 5th of April, the villages already ruined were again exposed to such violent shocks as would have been sufficient to destroy them. This extraordinary phenomenon was felt throughout the extent of 140 leagues from east to west, from the sea as far as the river Napo; and without doubt farther, for we are little acquainted with these districts which are inhabited by the savages. The distance north-east and south-west between Popayan and Piura, is reckoned to be 170 leagues; but in the centre of that district, 1 degree 16.6 from these places, is situated the part totally destroyed, and which comprehends 40 leagues from north to south between Guarandam and Machache, and twenty leagues from east to west. But, as if an earthquake alone had not been sufficient to ruin this fertile and populous country, another misfortune, hitherto unknown, was added. The earth opened, and formed immense gulfs; the summits of the mountains tumbled down into the valleys, and from the fissures in their sides there issued an immense quantity of fetid matter, which in a little time filled up valleys a thousand feet in depth and six hundred in breadth. It covered the villages, buildings, and inhabitants; choked up the sources of the purest springs, and being condensed by desiccation, in the course of a few days into an earthy and hard paste, it intercepted the course of rivers, made them flow backwards for the space of 87 days, and converted whole districts of dry land into lakes. Very extraordinary phenomena, which will doubtless be one day mentioned in history, occurred during these earthquakes; I shall, however, content myself with mentioning only two of them. At the same moment that the earth shook, the lake of Quirotoa, near the village of Insiloc, in the jurisdiction of Latacunga, took fire, and the vapour which rose from it suffocated the cattle and flocks that were feeding in the neighbourhood. Near the village of Pelileo, a large mountain named Moya, which was overturned in an instant, threw out a prodigious stream of the before-mentioned thick fetid matter, which destroyed and covered the miserable remains of that city. Naturalists will one day find, in these ravaged countries, objects worthy of their researches. Fragments of the minerals and earths of Tunguragua are about to be transported to Spain: but it is not in such fragments that we ought to search for the cause of these surprising phenomena; we must visit the country itself, where this conflict of the elements took place, and where the ruins it occasioned are still to be seen (G)."

224 In Scotland.

To the history of earthquakes now given, we shall only add the following account of the earthquakes which have taken place at Comrie in Perthshire, in Scotland, which was communicated to the Royal Society of Edinburgh, by Dr Finlayson, in a letter from Mr Taylor.

"The earthquakes which have lately (January 1790) taken place at Comrie (H) and its neighbourhood, are certainly very deserving of attention. I shall therefore cheerfully comply with your request, and give you as particular a description as I can of such of them as have been most remarkable. To give a particular account of all the noises or concussions which, during the last half year, have been heard or felt at Comrie, and within a short distance to the north, east, and west of that village, is beyond my power, and would indeed be of little use. With regard to these small concussions, it will be sufficient to say, that many of them have sometimes been observed to succeed one another in the space of a few hours; that they take place in all kinds of weather; that they are thought by some people to proceed from north-west to south-east, and by others, from north-east to south-west; that they have not been observed to affect the barometer; that they do not extend in any direction above three or four miles from Comrie; and that towards the south they are bounded by the Earn, which is in the immediate vicinity of the village. The same person, though bestowing the minutest attention, is often uncertain whether they proceed from the earth

(G) The volcano of Tunguragua occasioned an earthquake in 1557.

(H) Comrie is a village about 22 miles west of Perth, situated in the valley of Strathearn, and on the north side of the river Earn, about four miles below the place where it issues from the lake. The remains of a Roman camp on the opposite side of the river, have made the name of this village very well known to Scottish antiquaries.

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earth or from the air, sometimes believing them to come from the one, and sometimes from the other; neither do all agree with respect to the seat of any one of them.

"After the strictest inquiry, I find it impossible to determine with accuracy the date of any of the concussions which took place before the 2d of September last. Some people in the neighbourhood of Killin assert positively, that they heard unusual rumbling noises in the month of May; but the impression which these noises made was so faint, that they would probably have been soon forgotten altogether, had they not been succeeded by concussions of a less equivocal nature. Towards the end of August, two or three shocks are said to have been felt at Dundurn, Dunira Lodge and Comrie; but I have not been able to learn the precise day or hour on which any of them happened. The truth is, the concussions hitherto observed were feeble, and the minds of the people seem not to have been roused to particular attention till the 2d of September. About eleven o'clock that evening, a smart shock was felt at Comrie. I myself heard here, for the first time, a rumbling noise, which I took for that of a large table, dragged along the floor above stairs, and which I probably would never have thought of again, unless my attention had been turned to it by the alarm which it had excited in the neighbourhood. Many other feeble noises or concussions are said to have been observed in Glen Leadnach and about Comrie during the months of September and October. At this time, however, I confess I was disposed to doubt the numerous reports of earthquakes with which the country was filled, and to ascribe them to the workings of an imagination, on which the alarm of the 2d of September still continued to be impressed.

"On the 5th of November, a concussion took place two or three minutes before six o'clock P. M. which was too violent to be mistaken. Some compared the noise which accompanied it to that of heavy loaded waggons, dragged with great velocity along a hard road or pavement, and thought that it passed under their feet. To me it seemed as if an enormous weight had fallen from the roof of the house, and rolled with impetuosity along the floor of the rooms above; and it must have made a similar impression on the servants, for some of them instantly ran up stairs to discover what had happened. Others were sensible of a tremulous motion in the earth, perceived the flames of the candles to vibrate, and observed the mirrors and kitchen utensils placed along the walls to shake and clatter. There is also reason to believe that the waters in the loch of Monivaird, in the near neighbourhood of Ochtertyre, suffered unusual agitation, as the wild fowl then upon the loch were heard to scream and flutter. The noise on this occasion, as far as I can judge, did not last above ten or twelve seconds. During the course of the day, the mercury in the barometer rose and fell several times, and at six o'clock it stood at $28\frac{1}{2}$ inches. The sky was then perfectly serene, and hardly a breath of wind was to be felt; but next morning, about six o'clock, a violent tempest rose, which raged without intermission for 24 hours.

"At Glen Leadnach, Comrie and Lawers, this concussion was much more violent, and the noise that accompanied it much more alarming. The inhabitants of these places, and of Aberuchill and Dunira, declare, that they perceived distinctly the earth heaving under them, and the motion communicated to their chairs, and other furniture. They imagined that the slates and stones were tumbling from their houses, and many of them ran out in the greatest trepidation, from the notion, that the roofs were falling in. Even the domestic animals were alarmed, and contributed, by their howls and screams, to increase the terrors of the people. Though I have not been able to discover whether Loch Earn was ever agitated by these concussions, there is little doubt, that the river near Comrie was affected on this occasion, as two men then on its banks heard the dashing of its waters. This great shock was succeeded by a number of those slighter rumbling noises which have been already mentioned. Not less than 30 of them were counted in the space of two hours after it happened; but they did not extend above two miles to the east, north, and west of Comrie.

"On the 10th of November, at three o'clock P. M. we had here another shock of much the same length, violence, and extent, as that on the 5th. The mercury in the barometer on this day was more stationary than on the former, and at the time of the earthquake was 29 inches high. The weather was calm and hazy. It was a market-day at Comrie; and the people, who were assembled from all parts of the country, felt as if the mountains were to tumble instantly upon their heads. The hard-ware exposed for sale in the shops and booths shook and clattered, and the horses crowded together with signs of unusual terror.

"About one o'clock P. M. of the 29th December, we had another pretty smart shock, during a violent storm of wind and rain, which continued the whole day, and which was at its height during the time of the earthquake. Indeed, as has been remarked already, these concussions seem to have no dependence on the weather. According to the accounts of those who live nearest to the centre of the phenomena, rumbling noises, like those above described, may be heard in all states of the atmosphere.

"Though I mention no more of these earthquakes, you are not to conclude, that many more have not taken place, and some of them perhaps equally violent with those of the 5th and 10th of November. Several shocks have happened during the stillness of the night, which, even at this distance from Comrie, where their centre seems to be, have been abundantly terrifying. But the great resemblance, or rather the perfect similarity of their effects, and of the impression they make on our minds, renders it unnecessary for me to trouble you with a particular description of each of them.

"The direction of all the noises or concussions I have observed, great as well as small, appeared to be in the same line from N. W. to S. E. Others describe them as sometimes proceeding in that direction, and sometimes as coming from N. E. to S. W. I have not heard any other line of direction ascribed to them.

"Upon the fullest enquiry, I find, that these earthquakes have been very limited in point of extent. The greater shocks have been feebly felt at Loch Earn head, about Killin, and at Ardonich, on the southern bank of Loch Tay. They do not appear to have extended farther eastward on that lake; and, what is more remarkable, they had not been felt in Glen Almond,

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mond, or the small glen through which the military road from Crieff to Tay-bridge passes. The farmer at Auchnafree, (which lies at the head of Glen Almond, and is separated from Glen Leadnach only by the mountain Benechoni, over the northern side of which his shepherds daily travel), has assured me, that neither he, nor any of his people, have been at any time sensible of the least extraordinary noise or concussion. Towards the east, the two first great shocks extended to Monzie, Cultoquhey and Dollary, about seven miles distant from Comrie. The shock of the 5th of November reached still farther, and was felt, though but faintly, at Ardoch and Drummond Castle towards the S. E. In the direction of the south, however, the banks of the Earn seem to be its general boundary, as the noise of the most violent concussion was heard but faintly at the manse of Comrie, and along the strath on the south side of the river. The limits of the lesser concussions, I am confident, do not extend above three miles in any direction from their centre. They are commonly observed at Lawers on the east; throughout the whole of Glen Leadnach, at Dunira, Dalchonzie and Aberuchill, on the north and west; and do not reach so far as the manse, which is about three quarters of a mile on the south of Comrie (1)."

In another communication, dated in 1793, from the same gentleman, he observes, that " there is no reason to believe that these phenomena are yet come to an end. After temporary intermissions, sometimes of several months, they have returned, ever since their first appearance in 1789, without any apparent difference in their extent or force. The rumbling noises or slighter concussions, as usual, are observed at Comrie, in Glen Leadnach, and the places in their near neighbourhood; the more violent extend to much the same distance as formerly described. Having been only occasionally in that country since February 1791, I have not been able to ascertain dates. On the 2d of September 1791, at five minutes past five in the afternoon, a slight shock was felt at Ochtertyre. The barometer was not in order, on which account the weight of the atmosphere could not be ascertained. Its electrical state was tried by Saussure's electrometer, but no indication of any thing uncommon was perceived. Since that period, shocks have been observed at different times till within these few weeks past.

" From this account, it will be observed, that all the greater shocks have taken place in the season of autumn or the beginning of winter; that this has been now repeated for more than four years; and that those greater shocks have been succeeded at short intervals by rumbling noises or more feeble concussions. It has also been remarked, that they have in general been preceded or followed by great rains or boisterous weather; but variations in the weather take place so frequently in our climate at that season of the year, that the connection between them and the phenomena above described, is probably altogether accidental."

21 Causes of earthquakes

After the view which we have given of the phenomena and history of earthquakes, we now proceed to the consideration of the causes, by the operation of which, according to the speculations of philosophers, these terrible convulsions of nature, which spread ruin and desolation in some of the fairest portions of the earth, are to be accounted for. Various opinions have been formed, and various hypotheses have been proposed, for the explanation of these dreaded phenomena. According to some of the ancient philosophers, subterraneous clouds existed in the internal cavities of the earth, and these bursting into lightning, shook and demolished the vaults which contained them. This was the opinion of Anaxagoras. It was supposed by others, that earthquakes were owing to the falling in of immense arched roofs, which confined subterraneous fires; the vaults or arches being weakened by the constant burning of these fires. Some ascribed earthquakes to the vapour of water which was produced, and greatly rarefied, by means of internal fires; while others, among whom was Epicurus and some of the peripatetic philosophers, sought for the explanation of the phenomena of earthquakes, in the explosion of certain inflammable substances, which were exhaled from the internal cavities of the earth.

22 according to the ancients

23 the moderns

Some of the modern philosophers, as Gassendi, Kircher, Varenius, Des Cartes, and others, have adopted the last hypothesis, according to which it is supposed, that there are immense cavities in the earth, communicating with each other. Some of these cavities contain water, and others contain vapours and exhalations, arising from bituminous, sulphureous, and other inflammable substances. These combustible materials being kindled by some subterraneous spark, or by some actual flame, proceeding through narrow fissures from without, or by the heat evolved during the mixture of different substances, and the formation of new ones, produce commotions on the surface of the earth, according to the extent of the cavities, and the quantity and active nature of the inflamed matter. Those who support

(1) " The tract within which the concussions described in this letter appear to have been confined, is a space of a rectangular form, which extends from east to west along the north side of the Earn about 22 miles in length, by a little more than five in breadth; reckoning the utmost length from about Monzie to the head of Loch Tay, and the breadth from a little south of the Earn northward to the ridge which separates the branches of that river from those of the Almond. The whole of this tract is mountainous, except toward the eastern extremity, where it joins the low country, and on the banks of the river Earn on the south. It is intersected by narrow glens or valleys, the most considerable of which is Glen Leadnach, where the centre of the concussions seems to be placed. The mineralogy of this part of the country has not hitherto been accurately examined; but it is known in general, that the stone is the primary schistus, and in some places granite; that no mineral veins, nor any hot springs, have been found in it, and that no volcanic appearances have been observed. In the valleys, among the mountains, iron ore, of the kind that is called bog ore, is said to abound. Dr Hutton has remarked, that the line which terminates this tract on the south-east, seems to be nearly the same with that where the primary strata sink under the surface, and are covered by the secondary or horizontal strata. *Note by Mr Playfair.*"

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support this hypothesis think, that it receives illustration from a common experiment of mixing together iron filings and sulphur, and burying them in the earth; and in consequence of the chemical action of these substances on each other, and the elastic vapours thus produced, the shaking of the earth is effected.

13 Hypothesis of Woodward.

A different hypothesis has been proposed by Dr Woodward. According to this hypothesis, water is continually raised by means of subterraneous heat, from the abyss which he supposes to occupy the centre of the earth, to furnish rain and dew. Obstructions may take place in this process of nature, and whenever this happens a swelling and commotion are occasioned by the heat in the waters of the abyss. This force is at the same time exerted against the incumbent strata, and thus the agitation and concussion, with the other phenomena which accompany earthquakes, are produced.

9 Of Amontons.

Another hypothesis, different from any of these, has been proposed by M. Amontons, of which the following explanation is given. The atmosphere being taken at 45 miles high, and the density of the air increasing in proportion to the absolute height of the superincumbent column of fluid, it is shewn that at the depth of 43,528 fathoms below the surface of the earth, the air is but one-fourth lighter than mercury. But this depth is only about one seventy-fourth of the semidiameter of the earth. The immense sphere beyond this depth, the diameter of which is 6,451,538 fathoms, may perhaps be only filled with air: this air must be here greatly condensed, and heavier than the heaviest bodies with which we are at present acquainted. It is found by experiment, that the more air is compressed, the more do equal degrees of heat increase its elastic force, and the more capable it becomes of producing violent effects. As, for instance, the temperature of boiling water increases the elasticity of the air beyond its natural force in temperate climates, by a quantity equal to one-third of the weight with which it is pressed. Hence it is concluded, that a degree of heat which on the surface of the earth produces only a moderate effect, may occasion violent convulsions by the rarefaction of the denser air at great depths; but if it be considered that this condensed air may be exposed to much higher degrees of heat than that of boiling water, the elastic force of the air thus produced, and assisted by the great weight of a high column, may be more than sufficient to convulse and break up the solid orb of 43,528 fathoms, the weight of which, comparing it with that of the included air, would be trifling.

These hypotheses, however insufficient they may appear for explaining in a satisfactory manner the phenomena of earthquakes, were generally adopted till about the middle of the 18th century, when the knowledge of electricity began to be cultivated and extended. This principle was applied successively in the explanation of many natural phenomena, and, among others, the phenomena of earthquakes were ascribed to the same principle. An earthquake which was felt at London in the month of March 1749, directed the attention of philosophers to this explanation.

23 Of Stukeley.

The first who made this attempt, we believe, was Dr Stukeley, who had been much occupied about that time with electrical experiments. The consideration of the phenomena which accompanied this earthquake, led him to suppose that it could not be occasioned by vapours generated in the cavities of the earth, or by any process like fermentation, in which elastic fluids are formed and disengaged, to which such effects could be ascribed. He is of opinion, that no evidence has yet been brought to establish the probability of the existence of extensive cavities within the earth. On the contrary, he thinks there is good reason to presume, that it is in a great measure solid, so that there is little space for those changes which are supposed to be effected within the cavities, to take place. Coal pits, he adds, which have been frequently known to be on fire, and for a great length of time, never exhibited any of the phenomena which accompany an earthquake on the surface of the ground above.

The earthquake which visited London and other places of Britain, in March 1749, was felt in a circuit of 30 miles diameter; but there was no eruption of fire or vapour, and it was unattended with smoke or smell. From this consideration alone, of the extent of surface which felt the effects of the earthquake, he supposes that it could not be ascribed to the expansive force of subterraneous vapours; for, he observes, small fire-balls which are exploded in the air, emit a sulphureous smell to the distance of several miles. Now, it cannot be imagined, that so prodigious a force, acting instantaneously, on so great an extent of ground, should neither break the surface, nor indicate its presence either by the sight or smell. But if this effect is to be ascribed to fermentation, this process is not instantaneous; it continues many days, and the evaporation of such a quantity of inflammable matter would require a long space of time. Such an effect, therefore, can only be accounted for on electrical principles, the operation of which is always instantaneous.

If earthquakes were occasioned by vapours and subterraneous fermentations, explosions and eruptions, such processes would entirely destroy springs and fountains, wherever they had once existed. This, however, is contrary to what happens, for although springs are stopped, or otherwise changed, previous to an earthquake, or about the time it happens, they very often recover their former state. In the great earthquake which happened A. D. 17, in Asia Minor, and which shook a mass of earth 300 miles in diameter, and destroyed 13 great cities, neither the springs nor the face of the country received any injury.

If it be considered, that a subterraneous power capable of moving 30 miles in diameter, as in the earthquake mentioned above, which happened at London, must exist and operate at least 15 or 20 miles under the surface, the hypothesis of earthquakes being occasioned by the force of vapours will be found totally inapplicable, because this force must move an inverted cone of solid earth, the base of which is 30 miles in diameter, and the axis 15 or 20. This is an effect which is impossible to any known natural power, excepting that of electricity.

But besides, no subterraneous explosion can account for the singular effects of an earthquake on ships that are far out in the ocean. It has been already observed, that they seem as if they struck on a rock, or as if some solid body struck against their bottom. Even fishes, it is found, are particularly affected by the shock of an earthquake; but a subterraneous explosion could only produce on the water a gradual swell. It could not communicate

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communicate to it that impulse by which it produces effects, as if it were a stone projected with great force against solid bodies.

From the consideration of all these circumstances, Dr Stukeley is of opinion, that the phenomena of earthquakes can only be satisfactorily explained on electrical principles. He was particularly led to this opinion by directing his attention to the phenomena which accompanied the earthquakes which took place in England in 1749 and 1750. For five or six months previous to this time, the weather had been unusually warm; the wind was from the south and south-west, and there had been no rain, so that the earth was particularly prepared to receive an electrical shock. The flat country of Lincolnshire had suffered greatly from extreme drought, and hence, as dry weather is favourable to electricity, earthquakes and other similar phenomena are more frequent in southern regions of the world. Before the earthquake at London, all vegetables had been unusually premature, and it is well known how much electricity quickens vegetation. About the same time the aurora borealis had been very frequent. A very short time before the earthquake, it had exhibited unusual colours, and its motions were to the south, contrary to the ordinary direction. From these circumstances an earthquake was predicted by Italians and others who had been accustomed to the appearances which precede them. During this year, too, meteors of different kinds, as fire-balls, lightnings, and coruscations, had been common; and particularly it was observed in the night preceding the earthquake, and early in the morning on the day on which it happened, that coruscations were very frequent. In these circumstances nothing was wanting to produce an earthquake, according to this hypothesis, but the touch of a non-electric body. This body must be derived from the air or atmosphere; hence it is inferred, that if a non-electric could discharge its contents upon any part of the earth, in this prepared and highly electrical state, a violent commotion or earthquake must be produced; and as the discharge from an excited tube produces a shock on the human body, so the discharge of electric matter from an extent of many miles of solid earth, must produce an earthquake. The rattling, uncouth noise which attends it, is to be ascribed to the snap which is occasioned by the contact.

Before the earthquake alluded to came on, a black cloud suddenly covered the atmosphere to a great extent; the discharge of a shower, according to this hypothesis, probably occasioned the shock; and as the electrical snap precedes the shock, a sound was observed to roll from the Thames towards Temple-bar, before the motion of the houses ceased. This noise, which is generally the forerunner of earthquakes, it is supposed can only be accounted for on the principles of electricity. The contrary to this would take place, were these phenomena owing to subterraneous eruptions. The flames and sulphureous smells which accompany earthquakes, might, it is thought, be more easily accounted for on the same principles, than by eruptions from the bowels of the earth. The sudden concussion, too, seems to be produced by a motion which could only be excited by electricity, not proceeding from any convulsion in the interior parts of the earth, but from a uniform vibration along its surface, like that of a musical string, or like the vibratory motion of a glass, when the edge is rubbed with the finger. From the circumstance that earthquakes are chiefly fatal to places near the sea coasts, along the course of rivers, and elevated situations, a farther proof is derived, that they depend on the operation of electricity. The course or direction which the earthquake above alluded to took, affords an illustration of this point. Another argument in favour of the electrical hypothesis is drawn from the effects of the earthquake, or the state of the weather at the time, on persons of weak or nervous constitutions. To some these disorders proved at that time fatal; and its effects, in general, were similar to those of artificial electricity.

Of Beccaria.

A similar hypothesis was proposed by Beccaria, to account for the phenomena of earthquakes. He supposes that the electric matter to which these phenomena are owing, is lodged deep in the earth, and that it is this matter discharged from the earth, to restore the equilibrium or deficiency which the clouds in the atmosphere have sustained during thunder storms, by giving out their electrical matter to another part of the earth. This, he supposes, is confirmed by the noise resembling thunder, and the flashes of lightning which are perceived during earthquakes.

Of Priestley.

Dr Priestley proposes to construct, on the principles of Stukeley and Beccaria, an hypothesis which he thinks will explain the phenomena in a more satisfactory manner. For this purpose he supposes the electric matter to be some way or other accumulated on one part of the surface of the earth, and on account of the dryness of the season, not easily to diffuse itself. It may, as Beccaria supposes, force its way into the higher regions of the air, forming clouds in its passage out of the vapours which float in the atmosphere, and occasion a sudden shower, which may farther promote the passage of the fluid. The whole surface thus unloaded will receive a concussion like any other conducting substance, on parting with or receiving a quantity of the electric fluid. The rushing noise will likewise sweep over the whole extent of the country; and upon this supposition also, the fluid, in its discharge from the country, will naturally follow the course of the rivers, and also take the advantage of any eminences, to facilitate its ascent into the higher regions of the air. In making some experiments on the passage of the electrical fluid over water, he observed that it produced a tremulous motion, and therefore he concludes that it must receive a concussion resembling that which is given to the waves of the sea by an earthquake. To try this still farther, he immersed his hands in water, while an electrical flash passed over its surface, and he felt a sudden concussion, like that which is supposed to affect ships at sea during an earthquake. The impulse, which was felt in different parts of the water, was strongest near the place where the explosion was made.

"Pleased with this resemblance of the earthquake, he observes, I endeavoured to imitate that great natural phenomenon in other respects; and it being frosty weather, I took a plate of ice, and placed two sticks about three inches high on their ends, so that they would just stand with ease; and upon another part of the ice I placed a bottle, from the cork of which was suspended a brass ball with a fine thread. Then making the electrical flash pass over the surface of the ice, which it did

did with a very loud report, the nearer pillar fell down, while the more remote stood, and the ball which had hung nearly still, immediately began to make vibrations, about an inch in length, and nearly in a right line from the place of the flash.

"I afterwards diversified this apparatus, erecting more pillars, and suspending more pendulums, sometimes upon bladders stretched on the mouth of open vessels, and at other times on wet boards swimming in a vessel of water. This last method seemed to answer the best of any; for the board representing the earth, and the water the sea, the phenomena of them both during an earthquake may be imitated at the same time; pillars, &c. being erected on the board, and the electric flash being made to pass, either over the board, over the water, or over them both *."

The ingenious Dolomieu proposes to account for these phenomena on different principles. On this subject he makes the following observations with regard to the earthquakes which desolated Calabria in 1783, and the causes by which they were produced. "The sea, says he, during the earthquakes of 1783, had little share in the shocks on the main land. The mass of water experienced no general movement, or fluctuation, or oscillation; the waves did not rise above their ordinary limits. Those which on the night of the 5th February beat against the coast of Sicily, and which afterwards covered the point of the Faro of Messina, were only the effects of a particular cause. The fall of a mountain into the sea raised the waters, which received an undulating motion, as happens always in similar cases. The undulation reached from the point of Sicily beyond the cape of Rosacolmo, extending in length along the coast which runs to the south; but always with a decrease in elevation as it was more remote from Sicily. Whatever inquiries the author has made, he has not been able to discover, in all the details which have been given him, any proofs of the existence of electrical phenomena; no spark, no disengagement of the electrical fluid, which the Neapolitan naturalists wish to assign as the cause of earthquakes.

"The state of the atmosphere was not the same in the whole range of earthquakes. While the tempests and the rain seemed to have conspired with them for the destruction of Messina, the interior part of Calabria enjoyed very fine weather. A little rain fell in the plain in the morning of the 5th of February; but the sky was clear during the rest of the day. This month and that of March were not only pretty serene, but likewise warm. There were some storms and rain; but they were the natural attendants of the season.

"The moving force seems to have resided under Calabria itself, since the sea which surrounds it had no share in the oscillations or vibrations of the continent. This force seems also to have advanced along the ridge of the Apennines in ascending from the south to the north. But what power in nature is capable of producing such effects? I exclude electricity, which cannot accumulate continually during the course of a year, in a country surrounded with water, where every thing conspires to place this fluid in equilibrio. Fire remains to be considered. The element, by acting directly upon the solids, can only dilate them; then their expansion is progressive, and cannot produce violent and instantaneous movements. When fire acts upon fluids, such as air and water, it gives them an astonishing expansion; and we know that then their elastic force is capable of overcoming the greatest resistances. These appear the only means which nature could employ to operate the effects we speak of: but in all Calabria there is no vestige of a volcano; nothing to point out any interior combustion; no fire concealed in the centre of mountains, or under their base; a fire which could not exist without some external signs. The vapours dilated, the air rarefied by a heat constantly active, must have escaped through some of the crevices or clefts formed in the soil; they must have formed currents. Both flame and smoke must have issued by some one or other of these passages. These once opened, the pressure would have ceased; the force not meeting with any more resistance, would have lost its effect; and the earthquake could have no longer continued. None of these phenomena took place: we must then renounce the supposition of a combustion acting directly under Calabria. Let us see whether, having recourse to a fire at some distance from this province, and acting upon it only as an occasional cause, we shall be able to explain all the phenomena which have accompanied the shocks. Let us take for example Ætna in Sicily, and suppose large cavities under the mountains of Calabria; a supposition which *cannot be refused.* It is certain that immense subterraneous cavities do exist, since Ætna, in elevating itself by the accumulation of its explosions, must leave in the heart of the earth cavities proportioned to the greatness of the mass.

"The autumn of 1782 and the winter of 1783 were very rainy. The interior waters, augmented by those of the surface, may have run into those caverns which form the focus of Ætna: there they must have been converted into vapour capable of the highest degree of expansion, and must have pressed forcibly against every thing which opposed their dilatation. If they found canals to conduct them into the cavities of Calabria, they could not fail to occasion there all the calamities of which I have given the description.

"If the first cavity is separated from the second by a wall (so to speak) or some slight division, and this separation is broken down by the force of the elastic vapour, the whole force will act against the bottom and sides of the second. The focus of the shocks will appear to have changed place, and become weaker in the space which was agitated most violently by the first earthquake.

"The plain, which was undoubtedly the most slender part of the vault, yielded most easily. The city of Messina, placed upon low ground, experienced a shock which the buildings on higher grounds did not. The moving force ceased at once as suddenly as it acted violently. When, at the periods of the 7th of February and the 28th of March, the focus appeared changed, the plain scarce suffered any thing. The subterraneous noise, which preceded and accompanied the shocks, appeared always to come from the south-west, in the direction of Messina. It seemed like thunder under ground, which resounded beneath vaults.

"If Ætna, then, has been the occasional cause of the earthquakes, it has also prepared, for some time, the misfortunes of Calabria, by gradually opening a passage along the coast of Sicily to the foot of the Neptunian

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nian mountains: for during the earthquakes of 1780, which disturbed Messina the whole summer, they felt, for the whole length of that coast, from Taormina even to the Faro, considerable shocks; but near the villages of Alli and Fiume de Nisi, which are situated about the middle of that line, shocks so violent were experienced, that they dreaded lest the mouth of a volcano should open. Each shock resembled the effort of a mine that had not strength to make an explosion. It appears, that then the volcano opened a free passage for the expansion of its vapours, and that they have since circulated without restraint; since in the year 1783 the earthquake was almost nothing upon that part of Sicily, at the time that Messina buried under its ruins the half of its inhabitants."

234 Ascribed to the force of steam.

By others the phenomena of earthquakes have been ascribed to the force of vapour or steam, which, no doubt, is an agent sufficiently powerful, if it is confined so, that its prodigious elastic force may be exerted; but it is denied by those who oppose this hypothesis, that earthquakes, though very frequent in regions where subterranean fires are really known to exist, as in volcanic countries, always happen in such places, and therefore water cannot be converted into vapour. But, besides, it is well known, that this vapour, even admitting the possibility of its production in subterranean cavities would be re-converted into water, the moment it came in contact with a cold body, which would deprive it of the principle of heat, in combination with which water assumes the form of vapour.

Many objections might have been made to the hypotheses which have been proposed to account for earthquakes. Many of these will probably occur to the attentive reader, who is a little acquainted with the nature and properties of the agents by which they are supposed to be produced; but whatever may be the cause of these extraordinary phenomena, it appears that it is very far from being clearly ascertained. Perhaps all the agents which have been stated as the cause of earthquakes, may have some influence in contributing to the effect, and many operate at different times, and in different circumstances.

Sect. II. *Of Volcanoes.*

235 Volcanoes in every part of the world.

Volcanoes exist in almost every part of the world, from the north to the south pole. Hecla in Iceland, and a volcano which has been observed in Terra del Fuego, at the termination of the southern continent of America, nearly comprehend the extremities of the globe; and having mentioned these boundaries, it is unnecessary to observe, that they exist in all climates.

236 Number of them.

The number of volcanoes at present known, is not less than 100. The volcanoes of Europe are well known: these are Vesuvius in Italy, Ætna in Sicily, and Hecla in Iceland. To these may be added the volcanoes in the Æolian or Lipari islands on the coast of Italy, of which Stromboli is remarkable for having thrown out flames, without the eruption of other volcanic matter, for more than 2000 years. In Asia there is a volcano on Mount Taurus; five in Kamtschatka, 10 in the islands of Japan; one in the peak of Adam in the island of Ceylon; four which have been observed in Sumatra; and some others in different parts of the Asiatic continent or islands. There are also some volcanoes on the African continent, as well as in some of the islands. Volcanoes exist also in the American continent, and in many of the islands which have been discovered in the South seas.

23[illegible] Are a[illegible] near [illegible] sea,

Almost all volcanoes are in the immediate vicinity of the sea. Mount Taurus, in the interior of Asia, and some of the volcanoes in the Andes, are the only exceptions to this.

23[illegible] and in [illegible] tops [illegible] moun[illegible]

Another general remark which may be made with regard to volcanoes is, that they always occupy the tops of mountains. No volcano was ever found bursting out in plains. The existence of volcanoes at the bottom of the ocean seems to be an exception; but it is to be observed, that these are also in the peaks of mountains, which have been raised up from great depths at the bottom of the ocean.

23[illegible] Symp[illegible] of an [illegible]tion.

The first symptom of an approaching eruption is an increase of the smoke, if smoke has been emitted, in fair weather. This smoke is of a whitish colour; but, after some time, black smoke is observed to shoot up in the midst of the column of white smoke. These appearances are usually accompanied with explosions. The black smoke is then followed, at a shorter or longer distance of time, by a reddish-coloured flame. Showers of stones are afterwards thrown out, and some of them are projected to great heights in the air, which shews that the force by which they are impelled is very great. Along with these, ashes are likewise ejected. These phenomena, which daily increase in frequency and violence, are also usually preceded and accompanied by earthquakes, and hollow noises from the bowels of the earth, something like those that precede earthquakes unaccompanied with volcanic eruptions. The smoke, flame, and the quantity of stones and ashes, increase, and the stones are at last thrown out red hot.

The smoke which issues from the crater has been observed to be sometimes in a highly electrified state. The ashes are strongly attracted, and carried up along with the smoke to great heights in the atmosphere, forming a dense black column of vast height and size. Flashes of lightning are seen darting in a zig-zag direction, through the column of smoke and ashes; and this lightning is sometimes attended with thunder. But from some observations which have been made, this thunder and lightning are seemingly less intense than atmospheric electricity. When these terrible appearances have continued for four or five months, or for a longer or shorter time, according to the nature of the eruption, the lava begins to flow. This is a current of melted matter, which sometimes boils over the top, and sometimes, when the mountain is high, as is the case with Ætna, bursts out at the side, and makes a passage for itself. The period of the duration of the eruption is very different. Sometimes it continues to flow, at intervals, for the space of several weeks.

24[illegible] Matt[illegible] thrown [illegible] of vo[illegible] noes.

The matters ejected from volcanoes are lavas, which are either more or less consolidated; ashes, slags of different kinds, and stones which have undergone little or no fusion. For an account of the nature and properties of volcanic productions, see Mineralogy. Stones have been projected into the air from Mount Ætna, to the height of 7000 feet. A stone which was ejected from Vesuvius, measured 12 feet long, and 45 feet in circumference; and even larger masses have been thrown out from Ætna.

Water has been frequently ejected from volcanoes. This

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This water is sometimes cold, and sometimes hot. Eruptions of water have taken place, both from Vesuvius and Ætna. At one time salt water was ejected from Mount Vesuvius. Different opinions have been held concerning the origin of this water, or its connexion with the volcano. This is founded on the circumstance already taken notice of in the general remark which was made, that almost all volcanoes are in the vicinity of the sea.

It seems to be a singular circumstance in the history of volcanoes, that when once eruptions have commenced, they follow each other in rapid succession; and at other times that they cease for a long period. From the year 1447, Ætna ceased to throw out any fire till the year 1536, when a terrible eruption took place, accompanied with smoke, flame, ashes, and burning stones. This conflagration continued to rage with great violence for many weeks. The following year a river swelled and overflowed its banks to a great distance; furious squalls of wind succeeded, after which there was a terrible eruption from Ætna. The torrents of flaming and fused matter which flowed out, destroyed towns, villages, and vineyards, to a great extent. After the conflagration, the summit of the mountain fell in with a dreadful crash. For 100 years after this period, the eruptions seemed to observe some kind of regularity, returning periodically every 25 and 30 years. From the year 1686 to 1755, the same year on which the earthquake at Lisbon happened, for more than half a century, Ætna enjoyed profound repose.

The first considerable eruption of Vesuvius, the account of which is recorded in history, happened in the year 79 of the Christian era. It was this eruption which destroyed Herculaneum and Pompeii; but this was not the first eruption of this mountain, for the streets of these cities have been since discovered to be paved with lava. Since that time, 30 different eruptions have taken place. There was a very remarkable one in 1538.

Volcanoes become extinct and are rekindled.

It would appear that volcanoes seem to become quite extinct, and are rekindled. Some of the Roman writers, as Diodorus Siculus, Vitruvius, and others, speak of Vesuvius only as having been a volcano. After this period it burnt for 1000 years, and again became extinct, from 1136 to 1506. Pools of water had collected in the crater, and woods were growing on its sides, and even in the crater itself. Vesuvius has now burnt for three centuries past, as furiously as ever; but particularly, during the 18th century. Of 29 eruptions which have taken place from Vesuvius, since the reign of Titus, half of the number have happened in the 18th century.

Submarine volcanoes.

Beside the volcanoes, the history of which we have now briefly detailed, volcanoes are known to exist at the bottom of the ocean. These are distinguished by the name of *submarine volcanoes*. Excepting in situation, so far as the history of submarine volcanoes is known, they resemble the volcanoes on land. It would appear that they exist in the tops of mountains at the bottom of the ocean, and eject immense burning masses of matter in whirlwinds of ashes and pumice, with prodigious torrents of lava. Submarine volcanoes are either very few in number, or the places where they exist have not been ascertained. Those that are certainly known are at Santorin, the Azores, and Iceland. The island of Santorin, formerly called Thera and St Irene, was denominated by the Greeks, in allusion to its origin, Καμμενι, or "burnt." According to Pliny, there is a tradition, that it arose out of the sea, at a very remote but unknown period.

Without going far back into history, to inquire concerning the early eruptions of this volcano, we shall mention some of a later date, the existence of which is better ascertained. In 1457, an eruption took place, at which time ashes and red-hot rocks were ejected, with a great quantity of lava. This event, with the date of it, is recorded on a marble stone, erected near the gate of Fort Scarus, in Santorin. An eruption also took place in 1570. This produced a new island, called the *Little Kaminoi*. In 1650, the agitations of the volcanoes continued for the greater part of a year. Smyrna and Constantinople were incommoded with the ashes, which rushed from the ocean in whirlwinds of flame. The same volcano opened again in 1707. The Little Kaminoi, mentioned, was increased, and it is now more than three leagues in circumference. A violent eruption took place in 1767, which shook the earth greatly for some days, and raised the sea in such a manner, as to excite apprehensions of the destruction of the islands in the neighbourhood. A thick black smoke darkened the air, which was so infected with a strong smell of sulphur, that many persons and animals were suffocated by it. Black ashes resembling gunpowder were dispersed around, and torrents of flame issuing from the sea, and waving above it, to the height of several feet, lighted, at intervals, the horrid scene. At the end of 10 or 12 days the eruption began to be more moderate; and a new island which had been thrown up was discovered. When it was examined, many parts of it were still burning; but the next day, those whom curiosity had drawn to the spot, were compelled to betake themselves to flight. They felt the new soil moving; in some parts it rose, and sunk in others. The earth, sea, and sky, soon resumed their formidable appearance; the boiling sea changed colour; flames in rapid succession issued as from a furnace, but accompanied with ashes and pumice. The frightful noise of subterranean thunders was heard; it seemed as if enormous rocks, darting from the bottom of the abyss, beat against the vaults above it, and were alternately repelled and thrown up again. The repetition of their blows seemed to be distinctly heard. Some of them finding a passage, were seen flying up red hot into the air, and again falling into the sea from which they had been ejected. Masses were produced, held together for some days, and then disappeared. In this general disorder, large portions of the Little-Kaminoi were swallowed up. Meanwhile the labour of the volcano took a larger surface. Its ejections became prodigiously abundant, and a new island was seen forming. By successive additions continued for near four months, it made a junction with that produced in June. From the colour of its soil it was named the *Black Island*. It is larger than the Little Kaminoi, and is separated from it by a narrow strait. After frequent alarms for several months, the volcano opened again on the 15th of April in the following year; but the eruption was only for a moment, when it threw out a multitude of burning rocks, which fell at the distance of two miles.

Similar

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Similar submarine volcanoes have been observed near the island of St Michael, one of the Azores or Western islands in the Atlantic ocean. In the year 1638, near the island of St Michael, where the sea was known to be 120 feet deep, there arose, after an agitation of several weeks, an island about six miles round. It was again swallowed up in about the same space of time that had elapsed during its formation. In the year 1691, this volcano was in great agitation for a month. It convulsed the whole island of St Michael, and by the heat and violent commotion of the sea, as well as by the eruption of flames, ashes, and pumice, occasioned great damage; but in this case no island appeared. Similar eruptions were known in 1720, and in 1757. During the latter eruption, some of the islands were shaken to their foundations.

After this account of submarine volcanoes, of their effects, and of the islands formed by them, it would be unnecessary to enter into any detail of the submarine volcano which threw up an island off the coast of Iceland, in the year 1783. This island, the existence of which seemed to be fully ascertained, was again swallowed up in the ocean, and was seen no more.

243 Mud volcanoes.

Volcanoes of a very different kind have been described. The volcanoes to which we allude, have received the name of *mud volcanoes*, from ejecting a great quantity of mud. These, however, are similar to those which have been already described, in having volcanic motions and convulsive eruptions. The first volcano of this kind which was discovered is in the island of Sicily, near a place called Maccalouba, between Arragona and Girgenti. It is in a hill of a conical shape, truncated at the top, and 150 feet high. The summit is a plain, half a mile round, and the whole surface is covered with thick mud. The depth of the mud, which is supposed to be immense, is unknown. There is not the slightest appearance of vegetation upon it. In the rainy season the mud is much softened; the surface is even, and there is a general ebullition over it, which is accompanied with a very sensible rumbling noise. In the dry season, the mud acquires greater consistency, but without ceasing its motion. The plain assumes a form somewhat convex; a number of little cones are thrown up, which rarely rise to the height of two feet. Each of them has a crater, where a black mud is seen in constant agitation, and incessantly emitting bubbles of air. With these the latter insensibly rises, and as soon as the crater is full of it, it disgorges. The residue sinks, and the cone has a free crater until a new emission.

This hill is sometimes subject to alarming convulsions. Earthquakes are felt at the distance of two or three miles, accompanied with internal noises, resembling thunder. These increase for several days, and terminate in an eruption of a prodigious spout of mud, earth, and stones, which rises two or three hundred feet into the air. This explosion is repeated twice or thrice in the course of 24 hours. Some years pass over without any eruption, but it generally happens that the eruptions continue yearly for five years successively. An eruption from this mud volcano took place in 1777.

Phenomena somewhat similar have been described by Pallas, which he observed partly in the peninsula of the Kercha, the boundary of Europe to the south-east of Little Tartary, now Taurida, and partly in the island of Taman, which is separated from Kercha only by one of the mouths of the river Cuban. The island of Taman is situated in Asia. These places, he observes, are in flat countries where there are few hills, and those very little raised above the level of the sea. The whole is covered with beds of slime, mixed with sand, with some beds of marl and sea-shells. From this he concludes that no real volcanic pit can exist here. Copious springs of petroleum are found in several places, and also pools or syphons of various dimensions, through most of which a briny mud is disgorged in bubbles. Pallas observed several of these pools, both in the peninsula and in Taman. The last eruption which took place, he observes, was in 1794. This was the greatest and most copious that had been known. It proceeded from the top of a hill at the north point of Taman. The place where the new gulf opened was a pool, where the snow and rain water usually remained for a long time. The explosion came on with a noise like that of thunder, and with the appearance of a mass of fire in the form of a sheaf. This lasted only for about half an hour, and it was accompanied with a thick smoke; but the ebullition which threw up part of the liquid mud, continued till the next day, after which the mud ran slowly in streams down the hill. The mud discharged was of a soft clay, of a bluish ash colour, every where of the same nature, and mixed with brilliant sparks of mica, with a small quantity of marl, calcareous and sandy fragments of schistus, which seemed to have been torn from their beds.

Pallas supposes that a very deep coal mine had been for ages on fire, under Kercha and Taman, and that the sea having accidentally broken into the burning cavities of the mine, the expansion produced by the water converted into steam, and the struggle of the different aeriform substances to get free, forced the upper beds, broke them in pieces, and formed a passage to themselves. The vapours, as they escaped, carried the mud along with them. But others have supposed that these phenomena are not produced by fire; that the appearance of the sheaf of fire must have been extraneous, or, that it was only a quantity of inflammable air, which exploded when it came to the surface; or, perhaps it was altogether an illusion, from the appearances of the vapours which were emitted.

An account is given of a singular phenomenon, somewhat similar to the above, which was observed in 1711, at Bosely, near Wenlock, in Shropshire. After a great hurricane, the inhabitants were awakened in the middle of the night by commotions of the earth, which were accompanied with noise. Some persons went to an eminence from which the noise proceeded, and they saw water oozing through the turf, while at the same time inflammable air was emitted. The water was not hot. This continued for some time, but at last it ceased to throw out any inflammable air for some years, previous to the year 1746, when a second eruption took place, attended with similar circumstances.

We shall not dwell longer on the history of volcanoes. For a particular account of the most remarkable eruptions of the principal volcanoes in the world, the reader is referred to the history given under Ætna, Hecla, and Vesuvius. We shall now proceed to state some of the opinions and conjectures of philosophers,

phers with regard to the cause of these extraordinary phenomena.

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Volcanic eruptions have been ascribed to the action of the waters of the sea, bursting in upon an immense quantity of fused or burning matter; to the action of central fires, and to the decomposition of different substances, by which a great quantity of heat and inflammable substances is produced.

Causes of Volcanoes.

Water, according to some philosophers, is absolutely necessary for the formation of volcanoes. This opinion is supported by the circumstance of almost all volcanoes being near the sea. According to this opinion, they were all formed under the surface of the waters of the ocean. The first explosion at the formation of a volcano, it is supposed, was preceded by an earthquake. The first eruptions would be extremely violent, and immense quantities of matter would be ejected. Torrents of lava would continue to be discharged for a long series of ages, and thus the foundations of the burning mountain are laid in the bottom of the ocean. But it becomes a question, in what way the internal fire was preserved from extinction by the incumbent waters of the ocean? To this M. Houel replies, that the fire having disposed the substances in fusion to make an eruption, next laid open the earth, and emitted as much matter as it could discharge, with a force sufficient to overcome the resistance of the column of water, which would oppose its ascent; but as the strength of the fire diminished, the matter discharged was no longer expelled beyond the mouth; but, by accumulating there, soon closed up the orifice. Thus, only small orifices would be left sufficient for giving vent to the vapours of the volcano, and from which only small bubbles of air could ascend to the surface of the water, until new circumstances, such as originally gave occasion to the eruption of the volcano, again took place in the bowels of the earth, and produced new eruptions, either through the same or other mouths. The appearance of the sea over the new formed volcano, in its state of tranquillity, would then be similar to what it is betwixt the islands of Basilizzo and Pariaria. Columns of air bubbles are there ascending at the depth of more than 30 feet, and burst on their arriving at the surface. This air would continue to disengage itself with little disturbance as long as it issues forth only in small quantity, until, at the very instant of explosion, when prodigious quantities, generated in the burning focus, would make their way at once, and the same phenomena which originally took place would again make their appearance."

A volcano, while under water, cannot act precisely as it does in the open air. Its eruptions, though equally strong, cannot extend to so great a distance. The lava accumulates in greater quantity round the crater; the sand, ashes, and pozzolana are not carried away by the winds, but are deposited around its edges, and prevent the marine substances which are driven that way by the waters from entering. Thus they agglomerate with these bodies, and thus a pyramidal mount is formed of all the materials together.

In this manner M. Houel supposes that the mountain was gradually raised out of the sea by the accumulation of lava, &c. at every eruption, and that the cavern of the volcano was gradually enlarged, the lava being driven down into the bottom of the cavern by the continued action of the stones which the volcano is constantly throwing up; that it was there fused, and at last thrown out at the top of the mountain to accumulate on its sides. M. Houel's opinion about the volcanic fire we shall give in his own words.

"We cannot form any idea of fire subsisting alone, without any pabulum, and unconnected with any other principle. We never behold it but in conjunction with some other body, which nourishes and is consumed by it. The matter in fusion, which issues from the focus, is but the incombustible part of that which nourishes the fire, and into the bosom of which that active principle penetrates in search of pabulum. But as the fire acts only in proportion to the facility with which it can dissolve and evaporate, I am of opinion, that it is only the bottom of the volcano on which it acts; and that its action extends no farther than to keep these substances which it has melted in a constant state of ebullition. That fusible matter being discharged from the mouth of the volcano, and hardening as it is gradually cooled by the action of the air, produces that species of stones which are distinguished by the name of *lavas*. This lava, even when in the focus, and in a state of fluidity, must also possess a certain degree of solidity, on account of the gravity and density of its particles. It therefore opposes the fire with a degree of resistance which irritates it, and requires, to put it into a state of ebullition, a power proportioned to the bulk of the mass.

"That quantity of matter, when dissolved by the action of the fire, must constantly resemble any other thick substance in a state of ebullition. Small explosions are produced in various parts over the surface of every such substance while in a state of ebullition; and, by the bursting of these bubbles, a great number of small particles are scattered around. This is the very process carried on in the focus of a volcano, though on a scale immensely more large; and the vast explosions there produced expel every body which lies in their way with the utmost violence; nor is there any piece of lava which falls down from the upper part of the arch, of weight sufficient to resist this violent centrifugal force.

"The pabulum by which the internal fire is supported, M. Houel thinks to be substances contained in the mountain itself, together with bitumen, sulphur, and other inflammable materials, which may from time to time flow into the focus of the volcano in a melted state though the subterraneous ducts, and the explosions he ascribes to water making its way in the same manner. The water is converted into steam, which fills the cavern and pushes the melted lava out at the crater; this opinion is corroborated by the copious smoke which always precedes an irruption. But, combined with the water, there is always a quantity of other substances, whose effects precede, accompany, or follow the eruptions, and produce all the various phenomena which they display. The eruption of water from Ætna in the year 1775 proceeded undoubtedly from this cause. The sea, or some of the reservoirs in Ætna or the adjacent mountains, by some means discharged a vast quantity of water into the focus of the volcano. That water was instantly resolved into vapour, which filled the whole crater, and issued from the mouth of the crater. As soon as it made its way into the open atmosphere, it was condensed again into water, which streamed down the

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the sides of the mountain in a dreadful and destructive torrent."

Others have attempted to account for the existence of volcanic fire, on the supposition that it is derived from central fires, and to these it is supposed that volcanoes act the part of chimneys; while others are of opinion that they are owing to the chemical decomposition of different substances, by which inflammable matters are evolved, with a great deal of heat, and by means of the latter the combustible materials are kindled, and exhibit the phenomena which are thus proposed to be accounted for.

M. Patrin is one of the latest naturalists who, with the assistance of modern chemistry, has attempted to account for the phenomena of volcanoes on the principles of this science. For a full view of his theory, or rather of his fanciful conjectures on this subject, we must refer the reader to the work itself†. But the following is a recapitulation of the principles on which he gives this explanation. All volcanoes, he observes, in a state of activity, are in the vicinity of the sea, and are never found but in those places where sea salt is abundant. The volcanoes of the Mediterranean abstract the salt which the waters of the ocean hold in solution, and are constantly pouring in by the straits of Gibraltar. The strata of primitive schistus are the great laboratories in which volcanic matters are prepared, by a constant circulation of different fluids; but, according to this theory, these strata contribute no part of their own substance. They suffer no waste in the process.

† *Hist. Nat. de Minéral.* tom. v.

The sphere of the activity of volcanoes may be far extended in these strata, but they have no other outlet beside spiracles, by which the gaseous substances escape, of which one part is dissipated in the atmosphere, and the other becomes concrete by its combination with oxygen. The concretion of these fluids is supposed to be analogous to the concretion of the primitive matters of the globe, according to the theory of La Place; and the elective attractions determine, in the same way, the formation of stony crystals.

Volcanic eruptions are proportioned, in regard to their violence and duration, to the extent of the strata of schistus in which the volcanic fluids are accumulated. These fluids are,

1. *Muriatic acid*, which carries off the oxygen from the metallic oxides of the schistus.

2. *The oxygen of the atmosphere*, which constantly replaces in the metals that which was carried off by the muriatic acid.

3. *Carbonic acid gas*, which the water absorbs from the atmosphere, and conveys to the schistus, which always abounds in carbone.

4. *Hydrogen*, which proceeds from the decomposition of water. A part of this hydrogen is inflamed by electric explosions; the other united to carbonic acid forms oil, which becomes petroleum by its combination with sulphuric acid; and it is to this petroleum that the bitterness of sea water is owing.

5. *The electric fluid*, which is attracted from the atmosphere by the metals contained in the schistus. Sulphur seems to be the most homogeneous portion of this fluid, which has become concrete. Phosphorus is a modification of it, and it contributes to the fixation of oxygen. The sulphur formed in the schistus by means of the electric fluid, combines with the oxygen, and forms sulphuric acid, which decomposes the sea salt.

6. *The metalliferous fluid.* This forms the iron in lavas. It is the origin of metallic veins, and the colouring principle of organized bodies. This substance in its undecomposed state affords iron, but by decomposition it produces other metals. It is conjectured to be one of the principles of muriatic acid, and it contributes, along with phosphorus, to fix oxygen under an earthy form.

7. The last of the volcanic fluids is *azotic gas*. To this gas is owing the formation of the masses of carbonate of lime which are ejected by Vesuvius, and of the calcareous earth contained in lavas.

Such are the materials with which the author proposes to form the different substances which are produced in volcanoes, and by the operation of which he proposes to explain the phenomena of volcanic eruptions. Our readers will probably agree with us in thinking, that the present state of chemical science, even with the assistance of such hypothetical substances as the metalliferous fluids, is yet inadequate to give any degree of support to such opinions, even in the form of conjecture. We shall therefore dismiss it without farther remark.

24 Observations on the nature of the strata.

We shall now conclude this subject with some interesting observations by M. de Luc, on the nature of the strata in which volcanic fires exist.

"Volcanoes, he observes, have been more numerous on the surface of our continents, when they were under the waters of the ancient sea; and as this class of mountains, raised by subterranean fires, manifest themselves still on the shores of the present sea, and in the middle of its waters, it is of importance to geology and the philosophy of the earth to obtain as just ideas of them as possible.

"I have attended a great deal to this subject from my own observations; and I have shown, at different times, the errors into which several geologists and naturalists, in treating of it, have fallen.

"This class of mountains, in particular, requires that we should see them, that we should behold them during their eruptions, that we should have traced the progress of their lava, and have observed closely their explosions; that we should have made a numerous collection of the matters which they throw up under their different circumstances, that we might afterwards be able to study them in the cabinet, and to judge of their composition according to the phenomena which have been observed on the spot.

"This study is highly necessary when we apply it to geology and the philosophy of the earth, in order that we may avoid falling into those mistakes which make us ascribe to subterranean fires what does not belong to them, or which leads us to refuse them what really belongs to them.

"We read in the *Journal de Physique* for January 1804, under the title, *On the Cause of Volcanoes*, the following assertions:

'What is the nature of the matters which maintain these subterranean fires? We have seen that Chimboraço, all these enormous volcanoes of Peru, and the Peak of Teneriffe, are composed of porphyry.

'The Puy-de-Dôme is also composed of porphyry, as well as the Mont d'Or and the Cantal.

'Ætna,

'Ætna, Solfatara, and Vesuvius, are also of the porphyry kind.

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'These facts prove that the most considerable volcanoes with which we are acquainted are of porphyry.'

"This opinion, that the fires of volcanoes have their centres in such or such a rock, and that their lavas are produced from these rocks, has always appeared to me not to be founded on any certain data. Opinions also on this subject have varied; some having placed the origin of lava in horn rock, others in granite or schist, and at present it is assigned to porphyry.

"I have always been of opinion that nothing certain could be determined in regard to this point. It ever remains uncertain whether the seat of the matters of which lava is formed be in compact rocks, or in strata in the state of softness, pulverulent, and muddy.

"Those who see lava issue from a volcano in its state of fusion and incandescence, and in its cooling, are convinced that the nature of every thing is changed, that it exhibits a paste in which nothing can be known, except the substances which the volcanic fires have not reduced to fusion.

"But these substances contained in the paste of lava, and those which are the most numerous, show us, that the strata from which they proceed cannot be similar to those exposed to the view, nor even to the most profound strata to which we can penetrate.

"Admitting the hypothesis, that the strata from which the lavas proceed are in a pulverulent and muddy state, containing elements of all these small crystals, one may conceive how they are formed there, insulated, grouped, or solitary, and are found then in the lava in that state of insolution.

"The fragments of natural rocks thrown up by Vesuvius are not of the same kind as the matters of which the lava is composed. Most of these fragments are micaceous rocks with laminæ of greater or less size, and of a kind of granite called *syenite*. I have found some composed of white quartzy rock; it is found sometimes of calcareous rock.

"The most probable idea that can be formed in regard to the origin of these fragments is, that they have been carried from the borders of the strata through which the lava, that comes from great depths, has opened for itself a passage. These fragments are carried to the surface of the lava as far as the bottom of the chimney of the crater, whence they have been thrown out by explosions, mixed with fragments separated, or rather torn, from the lava; for it is not by the lava that they have been brought forth to view, but by explosions.

"Some of these fragments of natural rocks have not been attacked by the fire; others have more or less; which depends, no doubt, on the place which they occupied in the volcano, and on the time which they remained in it. The most of the latter have retained at their surface a crust of lava, and this crust contains substances which are not the same as that of the fragment it covers.

"On Vesuvius the strata pierced by eruptions are lower than the surface of the soil; in Auvergne and several places of Germany they are above; for this reason there are seen there in their place schists or granites, which the eruptions have broken to form for themselves a passage.

"No volcano rests on natural strata: they sometimes show themselves on the exterior; but they have been opened by eruptions, and their edges have remained in their place.

"The focus of no volcano exists or has existed in the cone which appears above the surface of the ground. They have been raised by eruptions, which, proceeding from great depths, have thrown them up through the upper strata. When it is said, therefore, that the volcanic mountains of Auvergne rest on granite, this is a mistake, and an incorrect expression has been used by those who have not formed a just idea of the phenomenon. Lava may have flowed upon granite or any other rock, and rested upon it; but this is never the case with the volcano itself: its bases are below all the rocks visible.

"It is from the bosom even of the lava, when in a state of fusion in the interior of the volcano, that all the explosions proceed. In that state of fusion they contain all the matters which produce fermentations, and the disengagement of expansible fluids.

"I have been enabled to ascertain this on Vesuvius as far as was possible. The continual noise which was heard through the two interior mouths of the crater which I had before my eyes, was that of an ebullition, accompanied with inflammable vapours, and the gerbes of burning matters which they threw up at intervals were separated pieces of the lava in its state of fusion. I saw several of them in the air change their form, and sometimes become flat on the bodies which they struck or embraced in falling. And among the most apparent of these fragments there are always a multitude of small ones of the size of peas and nuts, and still smaller ones, which show at their surface, by their asperities, all the characters of laceration.

"The name of *scoriæ* has been given to these fragments, to distinguish them from compact lava, though their composition be the same as that of the hardest lava; and it is for want of reflecting properly on this point that it has been said that it is the compact part only that we must observe, in order to judge of their nature. The pieces which I took from the flowing lava with an iron hook, have at their surface the same lacerations and the same asperities as the fragments thrown up by explosions, and both contain the same substances.

"This separation, by tearing off the parcels of the lava, effected by fermentations and explosions which proceed from their bosom, serves to explain those columns, sometimes prodigious, of volcanic sand, which rise from the principal crater. When seen with a magnifying glass, this sand exhibits nothing but lava reduced very small, the particles of which, rough with inequalities, have the bright black colour and the varnish of recent lava.

"Parcels of substances which exist in our strata, such as fragments of quartz, scales of mica, and crystals of feldspar, are found sometimes in lava. Similar matters must no doubt be disseminated in the composition of our globe, without there being reason to conclude that the strata from which they proceed are the same as the exterior strata. It is neither in the granites, the porphyries,

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ries, nor the horn rock, and still less in the schists and calcareous rocks, that the schorls of volcanoes, the leucites, and perhaps olivins, will be found. These small crystals are brought to view by the lava, otherwise they would be unknown to us.

"These lavas contain a great deal of iron, which they acquire neither from the granite nor porphyries. Might not one see in the ferruginous sand which is found in abundance on the borders of the sea near Naples, and in the environs of Rome, specimens of that kind of pulverulent strata from which lava proceeds?

"I have here offered enough to prove that it cannot be determined that lava proceeds from strata similar to those with which we are acquainted. The operations of volcanoes, those vast laboratories of nature, will always remain unknown to us, and on this subject our conjectures will always be very uncertain.

"What is the nature of that mixture which gives birth to these eruptions, that produce lava and throw up mountains? What we observe as certain is, that the introduction of the water of the sea is necessary to excite these fermentations, as containing marine acid, and other salts, which, united to the sulphuric acid, the bases of which are contained in abundance in the subterranean strata, determine these fermentations, which produce the disengagement of fire and other fluids, and all the grand effects that are the consequence.

Several naturalists have believed, and still believe, that fresh or rain water is sufficient for this purpose; but they are mistaken: this opinion is contradicted by every fact known. To be convinced of this, nothing is necessary but to take a short view of them. I have done it several times, as it is necessary to consider them often. I shall here enumerate the principal ones:—No burning mountain exists in the interior part of the earth; and all those which still burn are, without exception, in the neighbourhood of the sea, or surrounded by its waters. Among the deliquescent salts deposited by the smoke of volcanoes, we distinguish chiefly the marine salt, united to different bases. Several of the volcanoes of Iceland, and Hecla itself, sometimes throw up eruptions of water, which deposit marine salt in abundance. No extent of fresh water, however vast, gives birth to a volcano. These facts are sufficient to prove that the concurrence of sea-water is absolutely necessary to excite those fermentations which produce volcanoes.

"I shall here repeat the distinction I have already made between burnt-out volcanoes and the ancient volcanoes, that I may range them in two separate classes.

"When we simply give the name of *burnt-out* or *extinguished* volcanoes to volcanic mountains which are in the middle of the continents, it is to represent them as having burnt while the land was dry, and inhabited as it is at present; which is not a just idea. These volcanoes have burnt when the land on which they are raised was under the waters of the ancient sea, and none of them have burnt since our continents became dry. It is even very apparent that most of them were extinct before the retreat of the sea, as we find by numerous examples in the present sea.

"Those which I denominate extinct volcanoes are such as no longer burn, though surrounded by the sea, or placed on the borders of it. They would still burn, were not the inflammable matters by which they were raised really exhausted and consumed. Of this kind is the volcano of Agde, in Languedoc. Of this kind also are many of the volcanic islands which have not thrown up fire since time immemorial.

"M. Humboldt, in his letters written from Peru, speaks of the volcanoes which he visited, but what he says is not sufficiently precise to enable us to form a just idea of them. He represents Chimboraço as being composed of porphyry from its bottom to its summit, and adds, that the porphyry is 1900 toises in thickness; afterwards, he remarks, that it is almost improbable that Chimboraço, as well as Pichincha and Antisana, should be of a volcanic nature: 'The place by which we ascended, (says he), is composed of burnt and scorified rock, mixed with pumicestone, which resembles all the currents of lava in this country.'

"Here are two characters very different. If Chimboraço be porphyry from the top to the bottom, it is not composed of burnt and scorified rocks, mixed with pumicestone; and if it be composed of burnt rocks, it cannot be porphyry. This expression, *burnt and scorified rocks*, is not even exact, because it excites the idea of natural rocks, altered in their place by fire, and they are certainly lava which has been thrown up by the volcano. But the truth must be, that Chimboraço, and all the other volcanoes of Peru, are composed of volcanic matters, from their base at the level of the sea to the summit.

"I have just read in the *Annales du Muséum d'Histoire Naturelle**, a letter of the same traveller, written from Mexico, on his return from Peru, where, speaking of the volcanoes of Popayan, Pasto, Quito, and the other parts of the Andes, he says, 'Great masses of this fossil (*obsidian*) have issued from the craters; and the sides of these gulfs, which we closely examined, consist of porphyry, the base of which holds a mean between obsidian and pitchstone (*pechstein*).' M. Humboldt therefore considers obsidian, or black compact glass, as a natural fossil or rock, and not a volcanic glass†."

* No

† Jour. Mines, N° 93.

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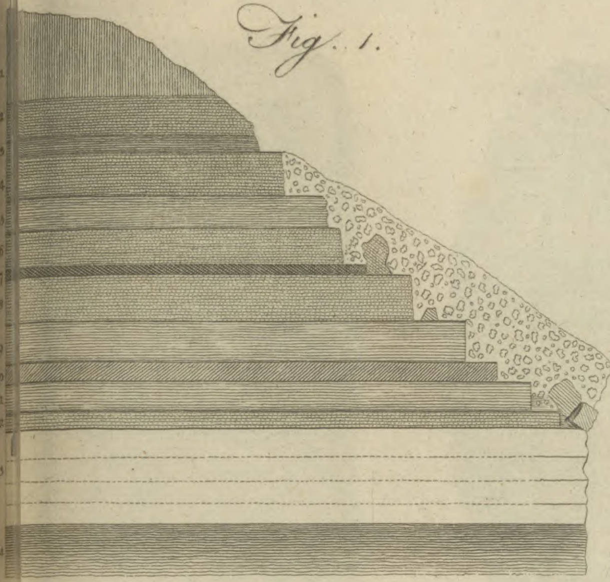
Fig. 1.



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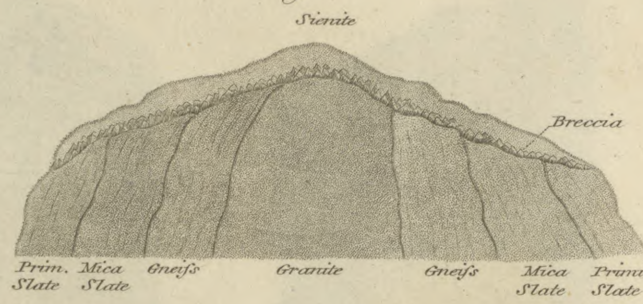

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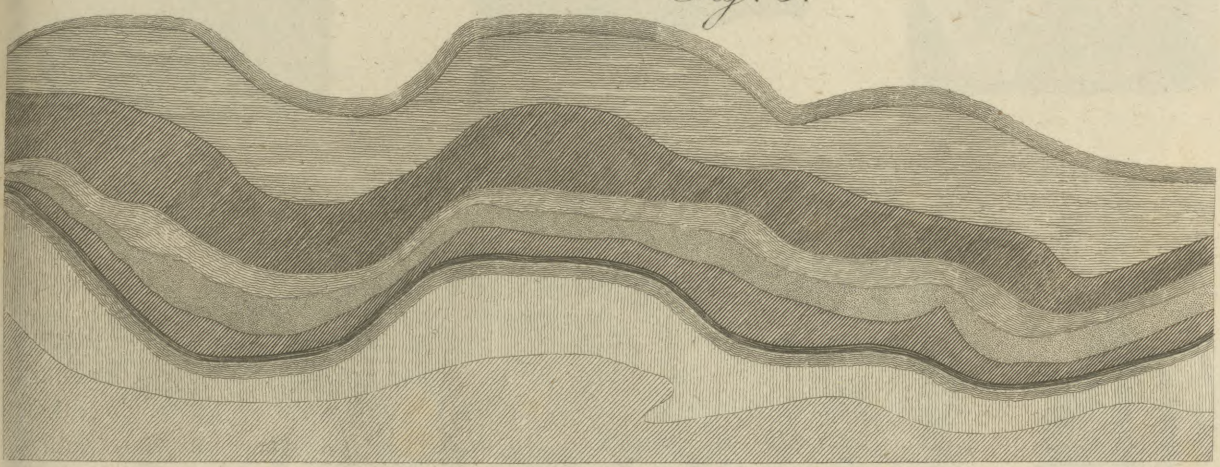
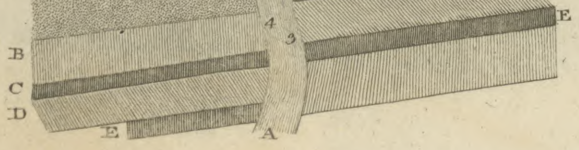


Fig. 4.

Fig. 5.



A. Bell Prin. Wal. Sculptor fecit.

Fig. 6.

Fig. 7.

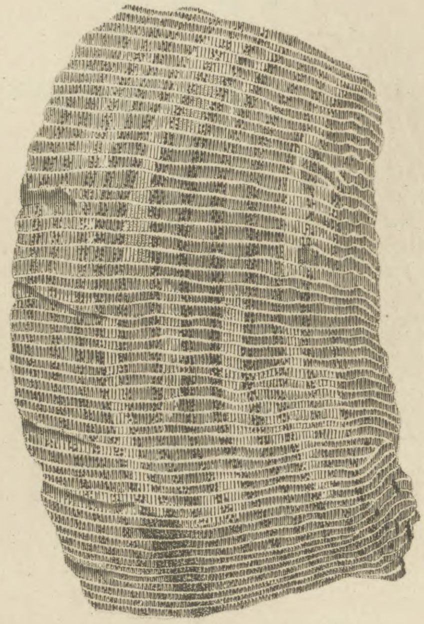


Fig. 8.

Fig. 10.

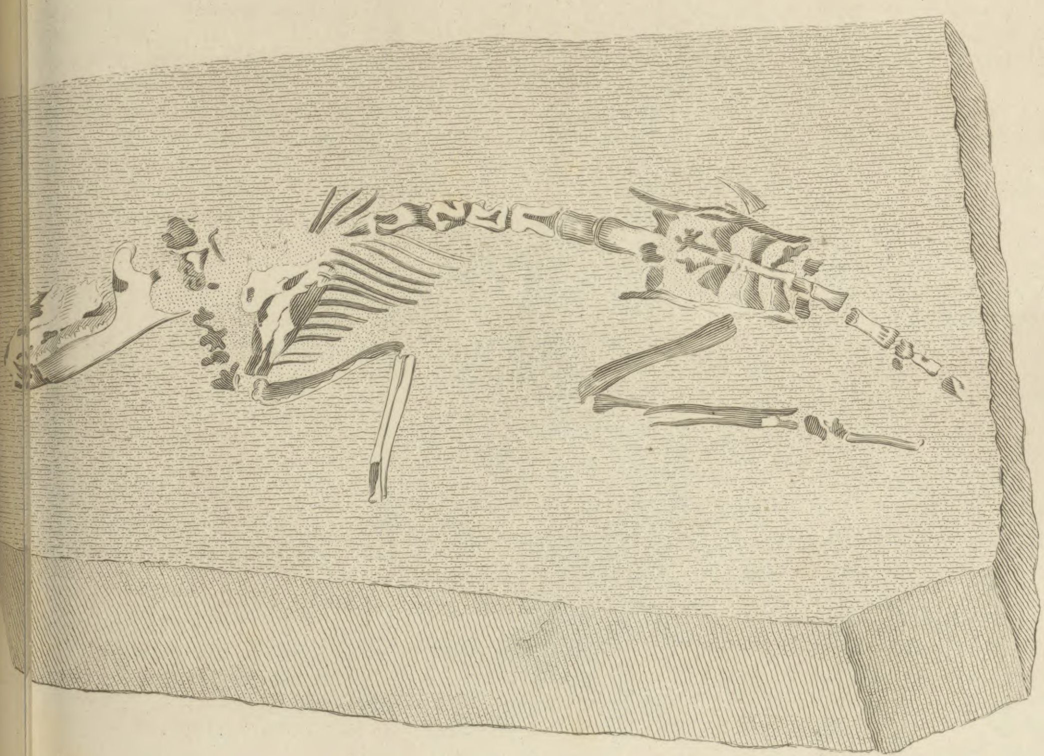


Fig. 9.

W. Archibald sculp.

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GEOMAN[...]

GEOMANCY, Geomantia, a kind of divination, performed by means of a number of little points, or dots, made on paper at random: and considering the various lines and figures which those points present; and thence forming a pretended judgment of futurity, and deciding any question proposed.

The word is formed of the Greek γη, *terra*, "earth;" and μαντεια, "divination;" it being the ancient custom to cast little pebbles on the ground, and thence to form their conjectures: instead of the points afterwards made use of.

Polydore Virgil defines geomancy a kind of divination performed by means of clefts or chinks made in the ground; and takes the Persian Magi to have been the inventors thereof.

GEOMETRY.

INTRODUCTION.

THERE is reason to believe that geometry, as well as most of the other sciences, was first cultivated in Egypt; and, according to some authors, it had its origin in the necessity there was of assigning to the inhabitants every year their particular shares of land: for as the country was annually overflowed by the Nile, it has been taken for granted (perhaps without good reason), that the land-marks would be obliterated, and the possessions rendered undistinguishable from one another. Such is said to have been the origin of land-measuring, the form under which geometry was first known, and from which it has taken its name; for geometry literally signifies *the measuring of the earth.*

The historian *Herodotus* refers the origin of geometry to the time when *Sesostris* intersected Egypt by numerous canals, and divided the country among the inhabitants; and this account of the beginning of the science has been considered by some as very probable.

From Egypt geometry was carried into Greece by *Thales* of Miletus about 600 years before the Christian æra. This celebrated philosopher is said to have made numerous discoveries in geometry; and in particular to have first observed that any angle in a semicircle is a right angle; a discovery which gave him great joy, and for which he thanked the muses by a sacrifice.

Among the disciples of *Thales* were *Anaximander* and *Anaxagoras:* the first of these wrote an elementary treatise or introduction to geometry, the earliest of which there is any mention in history; and the last is said to have attempted the quadrature of the circle, a problem which has baffled the skill of mathematicians of every age.

Pythagoras followed *Thales*, and had the merit of discovering one of the most beautiful and important propositions of the whole science, namely, that the square of the hypothenuse of a right-angled triangle is equal to the squares of the two other sides. He is said to have been so transported with joy at this discovery, that he sacrificed a hundred oxen to the gods as a testimony of his gratitude. The truth of this anecdote has however been doubted, on account of the philosopher's moderate fortune and religious opinions concerning the transmigration of souls.

Zenodorus is the earliest of the geometers whose writings have reached modern times, a part of them having been preserved by Theon, in his commentary on Ptolemy.

Hippocrates of Chios cultivated geometry, and distinguished himself by the quadrature of the curvilineal space contained between half the circumference of one circle, and the fourth part of the circumference of another circle, their concavities being both turned the same way, and the radius of the former to that of the latter as 1 to $\sqrt{2}$. He also wrote elements of geometry which are now lost.

The founding of the school of Plato forms one of the earliest and most important epochs in the history of geometry; for to that philosopher we are said to be indebted for the discovery of the *Geometrical Analysis*, by which the science has been greatly extended, and which is indeed absolutely necessary for the resolution of problems of a certain degree of difficulty.

The Conic Sections, and the theory of *Geometrical Loci*, are commonly reckoned among the improvements which geometry received from his disciples; and there is reason to suppose that these, as well as many other important discoveries which we have not room here to enumerate, were first suggested by the attempts of the geometers of the Platonic school to resolve two celebrated problems, namely, to trisect, or divide into three equal parts, a given angle; and to construct a cube which should be the double of another cube; which last problem *Hippocrates* had shewn to be equivalent to the finding of two mean proportionals between two given lines. The esteem in which *Plato* held the science of geometry is fully evinced by the following inscription over the door of his school: *Let no one enter here that is ignorant of geometry.*

The science of geometry was likewise cultivated in all its branches by the philosophers of the Alexandrian school, among whom *Euclid* claims, in a particular manner, our attention. This celebrated mathematician lived about 300 years before the Christian æra, and probably studied geometry at Athens under the disciples of *Plato*. From Greece he went to Alexandria, allured thither no doubt by the fame of the celebrated school of that city, and by the favours conferred by the first *Ptolemy* upon learned men. He composed elements of geometry in a systematic form, comprehending in them such propositions belonging to the first principles of the science as had been discovered by mathematicians previous to his time. This work has had the singular good fortune to preserve the highest reputation in all ages and in all countries where science has been cultivated, and it has served as the groundwork of innumerable other treatises, few of which, if any, have excelled it. Many commentaries have been written on it, and it has been translated into almost all

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the European and Oriental languages. *Euclid* is likewise known to have written other works on geometry: of these we have his *Data*, which may be regarded as a continuation of his elements; and an account of a work of his on *porisms* (see PORISMS) preserved in the writings of *Pappus*, but which has suffered so much from time as to be almost unintelligible.

After *Euclid*, lived *Archimedes*, who cultivated and improved all the branches of the mathematics known at that period, and in a particular manner geometry. He was the first that found nearly the ratio of the diameter of a circle to its circumference, and he squared the parabola. He likewise wrote treatises on the Sphere and Cylinder, on Spirals, on Conoids and Spheroids, besides others on mixt Mathematics. He also extended and improved the Geometrical Analysis, the principles of which had been established in the school of *Plato*. Many of the writings of *Archimedes* have been lost; but such as remain prove him to have been one of the greatest geometers that ever lived, and indeed the NEWTON of antiquity.

Apollonius of Perga was nearly contemporary with *Archimedes*, that is, he flourished about the end of the second century before the Christian æra. He studied geometry in the Alexandrian school under the successors of *Euclid*, and he greatly extended the theory of the conic sections (see introduction to CONIC SECTIONS). He also composed treatises on different parts of Geometrical Analysis, but of these only one has come down to us entire; it is entitled *de sectione rationis*, and was discovered in the Arabic tongue, from which it has been translated into Latin by *Dr Halley*. Such accounts however are preserved in the *mathematical collections of Pappus* of his other treatises, that several of them have been restored by modern mathematicians. We may mention in particular his treatises *de Locis Planis*, *de Sectione Spatii*, *de Sectione Determinata*, *de Tactionibus*, each of which is divided into two books.

Having mentioned *Archimedes* and *Apollonius*, by far the most illustrious mathematicians of the period in which they lived, we shall pass over several others who contributed nothing to the improvement of the science, and therefore are but little known to us. We shall however briefly notice *Theodosius*, who lived about 50 years A. C. and who is the author of a work on Spherics, which is considered as one of the most valuable of the books on the ancient geometry.

Pappus and *Theon* of Alexandria deserve to be mentioned as among the most celebrated of the commentators and annotators on the ancient geometry. We are particularly indebted to Pappus (who lived about the middle of the fourth century) for our knowledge of various discoveries and treatises of the ancient geometers, which, but for the account he has given of them in his *mathematical collections*, would have been for ever lost to mathematicians of modern times.

Proclus, the head of the Platonic school at Athens, cultivated mathematics about the middle of the fifth century; and although it does not appear that he made any discoveries in the science, yet he rendered it some service by his example and instruction. He wrote a commentary on the first book of Euclid, which contains many curious observations respecting the history and metaphysics of mathematics.

We have now briefly noticed the principal epochs in the history of geometry, and the most celebrated men who have contributed to its improvement from the earliest periods of history to the end of the fifth century; but long before this time the æra of discovery seems to have been past, and the science on the decline. Still however the Alexandrian school existed, and it was possible that a *Euclid* or an *Apollonius* might again arise in that seminary. But the taking of Alexandria by the Arabs in the year 641 gave a death-blow to the sciences, not only in that capital, but throughout the whole Greek empire. The library, a treasure of infinite value, was burnt, and the stores of learning which had been accumulating for ages were annihilated for ever.

Although by this unfortunate event the sciences suffered an irreparable loss, it must be attributed to the fanaticism of the new religion which the conquerors had adopted, rather than to national ignorance or barbarity; for before that period, the sciences, when on the decline in Greece, had found an asylum among them, and about 120 years after the death of Mohammed they again took them under their protection.

The Arabs translated the greater part of the works of the Greek geometers, and chiefly those introductory to astronomy. They even began to study the more sublime geometry of the ancients; for *Apollonius's* Conic Sections became familiar to them, and some of the books of that work have only reached us in an Arabic version. They gave to Trigonometry its present simple and commodious form, and greatly simplified its operations by the introduction of sines instead of the chords of double arcs, which had been formerly used.

After geometry, as well as its kindred mathematical sciences, had remained for several centuries under the protection of the Arabs, it was again received into Spain, Italy, and the rest of Europe, about the year 1400. Among the earliest writers on the subject after this period, were *Leonardus Pisanus*, and *Lucas Paciolus* or *de Burgo*.

The limits within which we must necessarily confine this sketch of the history of the science, will not, however, allow us to enumerate all the improvements which it has received since the restoration of letters in Europe; for a list of the names of those who have contributed more or less to its extension, would include almost every mathematician of note from the time of Leonardus Pisanus to the present day.

The writings of the ancient geometers have been assiduously sought after, and held in great repute; for it appears that as far as they carried some of their theories, they left but little room for improvement, and of this remark we think the writings of Euclid, of Archimedes, and of Apollonius, afford remarkable instances. Euclid's elements of geometry have been considered, at least in this country, as one of the best books that could be put into the hands of the mathematical student, particularly that edition of its first six and eleventh and twelfth books which was given to the world by the late *Dr Simson*. An excellent system of geometry, comprehending the first six books of the illustrious ancient, together with three supplementary books, has of late years been published by *Mr Professor Playfair*, of the University of Edinburgh. We believe no modern system has excelled that of *Euclid* (as

First Principles.

(as restored to its original purity by Dr Simson) in respect of logical accuracy and systematic arrangement. There is one, however, which we must particularly mention on account of its great excellence, and the use we have made of it in the system we are now to present to our readers. It is that of Mr Legendre, which we consider as the most complete and extensive that has yet appeared.

SECT. I. THE FIRST PRINCIPLES.

Definitions.

I. Geometry is a science which treats of the properties and relations of quantities having extension, and which are called magnitudes. Extension is distinguished into length, breadth, and thickness.

II. A *Point* is that which has position, but not magnitude.

III. A *Line* is that which has only length. Hence the extremities of a line are points, and the intersections of one line with another are also points.

IV. A *Straight* or *Right Line* is the shortest way from one point to another.

Plate CCXX. Fig. 1.

V. Every line which is neither straight, nor composed of straight lines, is a *Curve Line*. Thus AB is a straight line, ACDB is a line made up of straight lines, and AEB is a curve line.

VI. A *Superficies*, or *Surface*, is that which has only length and breadth. Hence the extremities of a superficies are lines, and the intersections of one superficies with another are also lines.

VII. A *Plane Superficies* is that in which any two points being taken, the straight line between them lies wholly in that superficies.

VIII. Every superficies which is neither plane nor composed of plane superficies, is a *Curve Superficies*.

IX. A *Solid* is that which has length, breadth, and thickness. Hence the boundaries of a solid are superficies; and the boundary which is common to two solids, which are contiguous, is a superficies.

X. A *Plane Rectilineal Angle* is the inclination of two straight lines to one another, which meet together, but are not in the same straight line. The point in which the lines meet one another is called the *Vertex* of the angle.

Fig. 2.

When there is only one angle at a point, it may be expressed by the letter placed at that point; thus the angle contained by the lines EF and EG may be called the angle E: if, however, there be several angles, as at B, then each is expressed by three letters, one of which is the letter that stands at the vertex of the angle, and the others are the letters that stand somewhere upon the lines containing the angle, the letter at the vertex being placed between the other two. Thus the angle contained by the lines BA and BD is called the angle ABD or DAB.

Angles in common with other quantities admit of addition, subtraction, multiplication, and division. Thus the sum of the angles ABC and DBC is the angle ABC; the difference of the angles ABC and ABD is the angle DBC.

Fig. 3.

XI. When a straight line standing on another straight line makes the adjacent angles equal to one another, each of them is called a *Right Angle*, and the straight line which stands on the other is called a *Perpendicular* to it. Thus, if DC meet AB, and make the angles ACD, DCB equal to one another; each of them is a right angle, and DC is a perpendicular to AB.

XII. An *Obtuse Angle* is that which is greater than a right angle, and an *Acute Angle* is that which is less than a right angle. Thus ABC being supposed a right angle, DBC is an obtuse angle, and EBC an acute angle. Fig. 4.

XIII. *Parallel Straight Lines* are such as are in the same plane, and which being produced ever so far both ways, do not meet. Fig. 5.

XIV. A *Plane Figure* is a plane terminated every where by lines.

If the lines be straight, the space which they enclose is called a *Rectilineal* figure, or a *Polygon*, and the lines themselves constitute the *Perimeter* of the polygon. Fig. 6.

XV. When a polygon has three sides (which is the smallest number it can have) it is called a *Triangle*; when it has four, it is called a *Quadrilateral*; when it has five, a *Pentagon*; when six, a *Hexagon*, &c.

XVI. An *Equilateral* triangle is that which has three equal sides (fig. 7.); an *Isosceles* triangle is that which has only two equal sides (fig. 8.); and a *Scalene* triangle is that which has all its sides unequal (fig. 9.). Fig. 7. 8. 9.

XVII. A *Right-angled* triangle is that which has a right angle; the side opposite to the right angle is called the *Hypothenuse*. Thus in the triangle ABC, having the angle at B a right angle, the side AC is the hypothenuse. Fig. 10.

XVIII. An *Obtuse-angled* triangle is that which has an obtuse angle, (fig. 9.); and an *acute-angled* triangle is that which has three acute angles (fig. 11.). Fig. 9. 11.

XIX. Of quadrilateral figures, a *square* is that which has all its sides equal, and all its angles right angles (fig. 12.). A *Rectangle* is that which has all its angles right angles, but not all its sides equal, (fig. 13.). A *Rhombus* is that which has all its sides equal, but its angles are not right angles, (fig. 14.). A *Parallelogram*, or *Rhomboid*, is that which has its opposite sides parallel (fig. 15.). A *Trapezoid* is that which has only two of its opposite sides parallel, (fig. 16.). Fig. 12. 13. 14. 15. 16.

XX. A *Diagonal* is a straight line which joins the vertices of two angles, which are not adjacent to each other; such is AC. Fig. 89.

XXI. An *Equilateral Polygon* is that which has all its sides equal; and an *Equiangular Polygon* is that which has all its angles equal. If a polygon be both equilateral and equiangular, it is called a *Regular Polygon*.

XXII. Two polygons are *equilateral* between themselves, when the sides of the one are equal to the sides of the other, each to each, and in the same order; that is, when in going about each of the figures in the same direction, the first side of the one is equal to the first side of the other; the second side of the one is equal to the

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the second side of the other; the third to the third, and so on. The same is to be understood of two polygons which are *equiangular* between themselves.

Explanation of Terms.

An *Axiom* is a proposition, the truth of which is evident at first sight.

A *Theorem* is a truth which becomes evident by a process of reasoning called *Demonstration.*

A *Problem* is a question proposed, which requires a solution.

A *Lemma* is a subsidiary truth employed in the demonstration of a theorem, or the solution of a problem.

The common name of *Proposition* is given indifferently to theorems, problems, and lemmas.

A *Corollary* is a consequence which follows from one or several propositions.

A *Scholium* is a remark upon one or more propositions that have gone before, tending to show their connection, their restriction, their extension, or the manner of their application.

A *Hypothesis* is a supposition made either in the enunciation of a proposition, or in the course of a demonstration.

Explanation of Signs.

That the demonstrations may be more concise, we shall make use of the following signs borrowed from Algebra; and in employing them we shall take for granted that the reader is acquainted with at least the manner of notation and first principles of that branch of mathematics.

To express that two quantities are equal the sign $=$ is put between them; thus $A = B$, signifies that the quantity denoted by A is equal to the quantity denoted by B.

To express that A is less than B, they are written thus; $A < B$.

To express that A is greater than B, they are written thus; $A > B$.

The sign $+$ (read *plus*) written between the letters which denote two quantities, indicates that the quantities are to be added together; thus $A+B$ means the sum of the quantities A and B.

The sign $-$ (read *minus*) written between two letters, means the excess of the one quantity above the other; thus $A-B$ means the excess of the quantity denoted by A above the quantity denoted by B. The signs $+$ and $-$ will sometimes occur in the same expression; thus $A+C-D$ means that D is to be subtracted from the sum of A and C, also $A-D+C$ means the same thing.

The sign $\times$ put between two quantities means their product, if they be considered as numbers; but if they be considered as lines, it signifies a rectangle having these lines for its length and breadth; thus $A\times B$ means the product of two numbers A and B; or else a rectangle having A and B for the sides about one of its right angles. We shall likewise indicate the product of two quantities, in some cases, by writing the letters close together; thus m A will be used to express the product of m and A, and so on with other expressions, agreeable to the common notation in algebra.

2

The expression A^2 means the square of the quantity A, and A^3 means the cube of A; also PQ^2, and PQ^3 mean, the one the square, and the other the cube, of a line whose extremities are the points P and Q.

On the other hand the sign $\surd$ indicates a root to be extracted; thus $\sqrt{A\times B}$ means the square root of the product of A and B.

AXIOMS.

1. Two quantities, each of which is equal to a third, are equal to one another.
2. The whole is greater than its part.
3. The whole is equal to the sum of all its parts.
4. Only one straight line can be drawn between two points.
5. Two magnitudes, whether they be lines, surfaces, or solids, are equal, when, being applied the one to the other, they coincide with one another entirely, that is, when they exactly fill the same space.
6. All right angles are equal to one another.

Note.—The references are to be understood thus: (7.) refers to the 7th proposition of the section in which it occurs; (4. 2.) means the 4th proposition of the 2d section; (2. cor. 28. 4.) means the 2d corollary to the 28th proposition of the 4th section.

THEOREM I.

Fig. 17.

A straight line CD, which meets with another AB, makes with it two adjacent angles, which, taken together, are equal to two right angles.

At the point C let CE be perpendicular to AB. The angle ACD is the sum of the angles ACE, ECD; therefore, $ACD+BCD$ is the sum of the three angles ACE, ECD, BCD. The first of these is a right angle, and the two others are together equal to a right angle; therefore, the sum of the two angles ACD, BCD, is equal to two right angles.

Cor. 1. If one of the angles is a right angle, the other is also a right angle.

Fig. 18.

Cor. 2. All the angles ACE, ECD, DCF, FCB, at the same point C, on the same side of the line AB, are taken together, equal to two right angles. For their sum is equal to the two angles ACD, DCB.

THEOREM II.

Two straight lines which coincide with each other in two points, also coincide in all their extent, and form but one and the same straight line.

Fig. 19.

Let the points which are common to the two lines be A and B; in the first place it is evident that they must coincide entirely between A and B; otherwise, two straight lines could be drawn from A to B, which is impossible (axiom 4.). Now let us suppose, if possible, that the lines when produced separate from each other at a point C, the one becoming ACD, and the other ACE. At the point C let CF be drawn, so as to make the angle ACF a right angle; then, ACE being a straight line, the angle FCE is a right angle (1. cor. 1.); and because ACD is a straight line, the angle

angle FCD is also a right angle, therefore the angle FCE is equal to FCD, a part to the whole, which is impossible; therefore the straight lines which have the common points A, B cannot separate when produced, therefore they must form one and the same straight line.

Theorem III.

Fig. 19. If two adjacent angles ACD, DCB make together two right angles, the two exterior lines AC, CB, which form these angles, are in the same straight line.

For if CB is not the line AC produced, let CE be that line produced, then, ACE being a straight line, the angles ACD, DCE are together equal to two right angles (1.); but, by hypothesis, the angles ACD, DCB are together equal to two right angles, therefore ACD+DCB=ACD+DCE. From these equals take away the common angle ACD, and the remaining angles DCB, DCE are equal, that is, a part equal to the whole, which is impossible, therefore CB is the line AC produced.

Theorem IV.

Fig. 20. If two straight lines AB, DE cut each other, the vertical or opposite angles are equal.

For since DE is a straight line, the sum of the angles ACD, ACE is equal to two right angles (1.), and since AB is a straight line, the sum of the angles ACE, BCE is equal to two right angles, therefore the sum ACD+ACE is equal to the sum ACE+BCE; from each of these take away the same angle ACE, and there remains the angle ACD equal to its opposite angle BCE.

In like manner, it may be demonstrated, that the angle ACE is equal to its opposite angle BCD.

Cor. 1. From this it appears, that if two straight lines cut one another, the angles they make at the point of their intersection are, together, equal to four right angles.

Cor. 2. And hence all the angles made by any number of lines meeting in one point are, together, equal to four right angles.

Theorem V.

Fig. 21. Two triangles are equal, when they have an angle, and the two sides containing it of the one equal to an angle, and the two sides containing it of the other, each to each.

Let the triangles ABC, DEF have the angle A equal to the angle D, the side AB equal to DE, and the side AC equal to DF; the triangles shall be equal. For if the triangle ABC be applied to the triangle DEF, so that the point A may be on D, and the line AB upon DE, then the point B shall coincide with E, because AB=DE; and the line AC shall coincide with DF, because the angle BAC is equal to EDF; and the point C shall coincide with F, because AC=DF; and since B coincides with E, and C with F, the line BC shall coincide with EF, and the two triangles shall coincide exactly, the one with the other; therefore they are equal (ax. 5.).

Cor. Hence it follows, that the bases, or third sides BC, EF of the triangles are equal, and the remaining angles B, C of the one are equal to the remaining angles E, F of the other, each to each, namely, those to which the equal sides are opposite.

Theorem VI.

Two triangles are equal, when they have a side, and the two adjacent angles of the one equal to a side, and the two adjacent angles of the other, each to each. Fig. 22.

Let the side BC be equal to the side EF, the angle B to the angle E, and the angle C to the angle F, the triangle ABC shall be equal to the triangle DEF. For if the triangle ABC be applied to the triangle DEF, so that the equal sides BC, EF may coincide; then because the angle B is equal to E, the side BA shall coincide with ED, and therefore the point A shall be somewhere in ED; and because the angle C is equal to F, the side CA shall coincide with FD, and therefore the point A shall be somewhere in FD; now the point A being somewhere in the lines ED, and FD, it can only be at D their intersection; therefore the two triangles ABC, DEF must entirely coincide, and be equal to one another.

Cor. Hence it appears that the remaining angles A, D of the triangles are equal, and the remaining sides AB, AC of the one are equal to the remaining sides DE, DF of the other, each to each, viz. those to which the equal angles are opposite.

Theorem VII.

Any two sides of a triangle are together greater than the third. Fig. 22.

For the side BC, for example, being the shortest way between the points B, C, (def. 4.) must be less than BA+AC.

Theorem VIII.

If from a point O, within a triangle ABC, there be drawn straight lines OB, OC to the extremities of BC one of its sides, the sum of these lines shall be less than that of AB, AC the two other sides. Fig. 23.

Let BO be produced to meet CA in D; because the straight line OC is less than OD+DC, to each of these add BO, and BO+OC$\angle$BO+OD+DC; that is BO+OC$\angle$BD+DC.

Again, since BD$\angle$BA+AD, to each of these add DC and we have BD+DC$\angle$BA+AC, but it has been shewn that BO+OC$\angle$BD+DC, much more then is BO+OC$\angle$BA+AC.

Theorem IX.

If two sides AB, AC of a triangle ABC are equal to two sides DE, DF of another triangle DEF, each to each; but if the angle BAC contained by Fig. 24. Fig. 25. Fig. 26.

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by the former is greater than the angle EDF contained by the latter; the third side BC of the first triangle shall be greater than the third side EF of the second.

Suppose AG drawn so that the angle $CAG=D$, take $AG=DE$ and join CG; then the triangle GAC is equal to the triangle EDF, (6.) and therefore $GC=EF$. Now there may be three cases, according as the point G falls without the triangle BAC, or on the side BC, or within the same triangle.

Fig. 24. Case I. Because $GC<GI+IC$, and $AB<AI+IB$, (7.) therefore $GC+AB<GI+AI+IC+IB$, that is $GC+AB<AG+BC$, from each of these unequal quantities take away the equal quantities AB, AG, and there remains $GC<BC$, therefore $EF<BC$.

Fig. 25. Case II. If the point G fall upon the side BC, then it is evident that GC, or its equal EF, is less than BC.

Fig. 26. Case III. Lastly, if the point G fall within the triangle BAC, then $AG+GC<AB+BC$, (8.) therefore, taking away the equal quantities AG, AB, there remains $GC<BC$ or $EF<BC$.

Cor. Hence, conversely, if EF be less than BC, the angle EDF is less than BAC; for the angle EDF cannot be equal to BAC, because then (5.) EF would be equal to BC; neither can the angle EDF be greater than BAC, for then (by the theor.) EF would be greater than BC.

Theorem X.

Fig. 22. Two triangles are equal, when the three sides of the one are equal to the three sides of the other, each to each.

Let the side $AB=DE$, $AC=DF$, and $BC=EF$; then shall the angle $A=D$, $B=E$, $C=F$.

For if the angle A were greater than D, as the sides AB, AC, are equal to DE, DF, each to each, it would follow, (9.) that BC would be greater than EF, and if the angle A were less than the angle D, then BC would be less than EF; but BC is equal to EF, therefore the angle A can neither be greater nor less than the angle D, therefore it must be equal to it. In the same manner it may be proved, that the angle $B=E$, and that the angle $C=F$.

Scholium.

It may be remarked, as in Theorem V. and Theorem VI. that the equal angles are opposite to the equal sides.

Theorem XI.

Fig. 27. In an isosceles triangle the angles opposite to the equal sides are equal to one another.

Let the side $AB=AC$, then shall the angle $C=B$. Suppose a straight line drawn from A the *vertex* of the triangle to D the middle of its base; the two triangles ABD, ACD have the three sides of the one equal to the three sides of the other, each to each, namely AD common to both, $AB=AC$, by hypothesis, and $BD=DC$, by construction, therefore (preced. theor.) the angle B is equal to the angle C.

Cor. Hence every equilateral triangle is also equiangular.

Scholium.

From the equality of the triangles ABD, ACD, it follows, that the angle $BAD=DAC$, and that the angle $BDA=ADC$; therefore these two last are right angles. Hence it appears, that a straight line drawn from the vertex of an isosceles triangle to the middle of its base is perpendicular to that base, and divides the vertical angle into two equal parts.

In a triangle that is not isosceles, any one of its three sides may be taken indifferently for a *base*; and then its *vertex* is that of the opposite angle. In an isosceles triangle, the base is that side which is not equal to the others.

Theorem XII.

If two angles of a triangle are equal, the opposite sides are equal, and the triangle is isosceles. Fig. 28

Let the angle $ABC=ACB$, the side AC shall be equal to the side AB. For if the sides are not equal, let AB be the greater of the two; take $BD=AC$, and join CD; the angle DBC is by hypothesis equal to ACB, and the two sides DB, BC are equal to the two sides AC, BC, each to each; therefore the triangle DBC is equal to the triangle ACB; (5.) but a part cannot be equal to the whole; therefore the sides AB, AC cannot be unequal, that is, they are equal, and the triangle is isosceles.

Theorem XIII.

Of the two sides of a triangle, that is the greater which is opposite to the greater angle; and conversely, of the two angles of a triangle, that is the greater which is opposite to the greater side. Fig. 29

First, let the angle $C>B$, then shall the side AB opposite to C be greater than the side AC opposite to B. Suppose CD drawn, so that the angle $BCD=B$; in the triangle BDC, BD is equal to DC, (12.) but $AD+DC>AC$, and $AD+DC=AD+DB=AB$, therefore $AB>AC$.

Next, let the side $AB>AC$, then shall the angle C opposite to AB, be greater than the angle B, opposite to AC. For if C were less than B, then, by what has been demonstrated, $AB<AC$, which is contrary to the hypothesis of the proposition, therefore C is not less than B: and if C were equal to B, then it would follow that $AC=AB$, (12.) which is also contrary to the hypothesis; therefore C is not equal to B, therefore it is greater.

Theorem XIV.

From a given point A without a straight line DE, no more than one perpendicular can be drawn to that line. Fig. 30

For suppose it possible to draw two, AB and AC; produce

produce one of them AB, so that BF=AB, and join CF. The triangle CBF is equal to the triangle ABC, for the angle CBF is a right angle, as well as CBA, and the side BF=BA; therefore the triangles are equal, (5.) and hence the angle BCF=BCA; but the angle BCA is by hypothesis a right angle; therefore the angle BCF is also a right angle; hence AC and CF lie in a straight line, (3.) and consequently two straight lines ACF, ABF may be drawn between two points, A,F, which is impossible, (ax. 4.) therefore it is equally impossible that two perpendiculars can be drawn from the same point to the same straight line.

Theorem XV.

Fig. 30. If from a point A, without a straight line, DE, a perpendicular AB be drawn upon that line, and also different oblique lines AE, AC, AD, &c. to different points of the same line.

First, The perpendicular AB shall be shorter than any one of the oblique lines.

Secondly, The two oblique lines AC, AE, which meet the line DE on opposite sides of the perpendicular, and at equal distances BC, BE from it, are equal to one another.

Lastly, Of any two oblique lines AC, AD, or AE, AD, that which is more remote from the perpendicular is the greater.

Produce the perpendicular AB, so that BF=BA, and join FC, FD.

1. The triangle BCF is equal to the triangle BCA; for the right angle CBF=CBA, the side CB is common, and the side BF=BA, therefore the third side CF=AC, (5.) but AF$\angle$AC+CF, (7.) that is 2 AB$\angle$2 AC; therefore AB$\angle$AC, that is, the perpendicular is shorter than any one of the oblique lines.

2. If BE=BC, then, as AB is common to the two triangles ABE, ABC, and the right angle ABE=ABC, the triangles ABE, ABC shall be equal, (5.) and AE=AC.

3. In the triangle DFA, the sum of the lines AD, DF is greater than the sum of AC, CF, (8.) that is, 2 AD$>$2 AC; therefore AD$>$AC, that is, the oblique line, which is more remote from the perpendicular, is greater than that which is nearer.

Cor. 1. The perpendicular measures the distance of any point from a straight line.

Cor. 2. From the same point, three equal straight lines cannot be drawn to terminate in a given straight line; for if they could be drawn, then, two of them would be on the same side of the perpendicular, and equal to each other, which is impossible.

Theorem XVI.

Fig. 31. If from C, the middle of a straight line AB, a perpendicular CD be drawn to that line. First, Every point in the perpendicular is equally distant from the extremities of the line AB. Secondly, Every point without the perpendicular is at unequal distances from the same extremities, A B.

1. Let D be any point in CD, then, because the two oblique lines DA, DB are equally distant from the perpendicular, they are equal to one another (15.), therefore every point in CD is equally distant from the extremities of AB.

2. Let E be a point out of the perpendicular; join EA, EB, one of these lines must cut the perpendicular in F; join BF, then AF=BF, and AE=BF+FE; but BF+FE$>$BE, (7.) therefore AE$>$BE, that is, E any point out of the perpendicular is at unequal distances from the extremities of AB.

Theorem XVII.

Plate CCXLI. Fig. 32. Two right-angled triangles are equal, when the hypothenuse and a side of the one are equal to the hypothenuse and a side of the other, each to each.

Let the hypothenuse AC=DF, and the side AB=DE; the triangle ABC shall be equal to DEF. The proposition will evidently be true (10.) if the remaining sides BC, EF are equal. Now, if it be possible to suppose that they are unequal, let BC be the greater, take BG=EF, and join AG; then the triangles ABG, DEF, having the side AB=DE, BG=EF, and the angle B=E, will be equal to one another (5.), and will have the remaining side AG=DF; but by hypothesis DF=AC; therefore AG=AC; but AG cannot be equal to AC (15.), therefore it is impossible that BC can be unequal to EF, and therefore the triangles ABC, DEF are equal to one another.

Theorem XVIII.

Two straight lines AC, ED, which are perpendicular to a third straight line AE, are parallel to each other. Fig. 33.

For if they could meet at a point O, then two perpendiculars OA, OE, might be drawn from the same point O, to the straight line AE, which is impossible (14.).

In the next theorem, it is necessary to assume another axiom, in addition to those already laid down in the beginning of this section.

Axiom.

7. If two points E, G in a straight line AB are situated at unequal distances EF, GH from another straight line CD in the same plane, these two lines, when indefinitely produced, on the side of the least distance GH, will meet each other. Fig. 34.

Theorem XIX.

If two straight lines AB, CD be parallel, the perpendiculars EF, GH to one of the lines, which are terminated by the other line, are equal, and are perpendicular to both the parallels. Fig. 35.

For if EF and GH, which are perpendicular to CD, were unequal, the lines AB, CD would meet each other (by the above axiom) which is contrary to the supposition that they are parallel. And if EF, GH be

not

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not perpendicular to AB, let EK be perpendicular to EF, meeting GH in K; then because EK and FH are perpendicular to EF, they are parallel (18.), and therefore, by what has been just shewn, the perpendiculars EF, KH, must be equal; but by hypothesis EF=GH, therefore KH=GH, which is impossible; therefore EF is perpendicular to AB; and in the same way it may be shewn that GH is perpendicular to AB.

Cor. Hence it appears, that through the same point E, no more than one parallel can be drawn to the same straight line CD.

Theorem XX.

Fig. 36. Straight lines AB, EF, which are parallel to the same straight line CD, are parallel to each other.

For let HKG be perpendicular to CD, it will also be perpendicular to both AB and EF (19.), therefore these last lines are parallel to each other.

Theorem XXI.

Fig. 37. If a straight line EF meet two parallel straight lines AB, CD, it makes the alternate angles AEF, EFD equal.

Let EH and GF be perpendicular to CD, then these lines will be parallel (18.), and also at right angles to AB (19.), and therefore FH and GE are equal to one another (19.), therefore the triangles FGE, FHE, having the side FG=HE, and GE=FH, and FE common to both, will be equal; and hence the angle FEG will be equal to EFH, that is, FEA will be equal to EFD.

Cor. 1. Hence if a straight line KL intersect two parallel straight lines AB, CD, it makes the exterior angle KEB equal to the interior and opposite angle EFD on the same side of the line. For the angle AEF=KEB, and it has been shewn that AEF=EFD; therefore KEB=EFD.

Cor. 2. Hence also, if a straight line EF meet two parallel straight lines AB, CD, it makes the two interior angles BEF, EFD on the same side together, equal to two right angles. For the angle AEF has been shewn to be equal to EFD, therefore, adding the angle FEB to both, AEF + FEB=EFD+FEB; but AEF+FEB is equal to two right angles, therefore the sum EFD+FEB is also equal to two right angles.

Theorem XXII.

Fig. 38. If a straight line EF, meeting two other straight lines AB, CD, makes the alternate angles AEF, EFD equal, those lines shall be parallel.

For if AE is not parallel to CD, suppose, if possible, that some other line KE can be drawn through E, parallel to CD; then the angle KEF must be equal to EFD (21.), that is (by hypothesis), to AEF, which is impossible; therefore, neither KE, nor any other line drawn through E, except AB, can be parallel to CD.

Cor. If a straight line EF intersecting two other straight lines AB, CD, makes the exterior angle GEB equal to the interior and opposite angle EFD on the same side; or the two interior angles BEF, EFD on the same side equal to two right angles; in either case the lines are parallel. For, if the angle GEB=EFD, then also AEF=EFD, (4.). And if BEF+EFD= two right angles, then, because BEF+AEF=two right angles (1.), BEF+EFD=BEF+AEF, and taking BEF from both, EFD=AEF, therefore (by the theorem) in each case the lines are parallel.

Theorem XXIII.

Fig. 39. If a side AC of a triangle ABC be produced towards D, the exterior angle BCD is equal to both the interior and opposite angles BAC, ABC.

Let CE be parallel to AB, then the angle B=BCE, (21.) and the angle A=ECD, (1 cor. 21.) therefore B+A=BCE+ECD=BCD.

Cor. The exterior angle of a triangle is greater than either of the interior opposite angles.

Theorem XXIV.

Fig. 40. The three interior angles of a triangle ABC taken together are equal to two right angles.

For if AC be produced to D, then A+B=BCD, (23.); to each of these equal quantities add ACB, then shall A+B+ACB=BCD+BCA; but BCD+BCA =two right angles, (1.) therefore A+B+ACB=two right angles.

Cor. 1. If two angles of one triangle be equal to two angles of another triangle, each to each; the third angle of the one shall be equal to the third angle of the other, and the triangles shall be equiangular.

Cor. 2. If two angles of a triangle, or their sum, be given, the third angle may be found, by subtracting their sum from two right angles.

Cor. 3. In a right-angled triangle, the sum of the two acute angles is equal to a right angle.

Cor. 4. In an equilateral triangle, each of the angles is equal to the third part of two right angles, or to two thirds of one right angle.

Theorem XXV.

Fig. 41. The sum of all the interior angles of a polygon is equal to twice as many right angles wanting four as the figure has sides.

Let ABCDE be a polygon; from a point F within it draw straight lines to all its angles, then the polygon shall be divided into as many triangles as it has sides; but the sum of the angles of each triangle is equal to two right angles, (24.) therefore the sum of all the angles of the triangles is equal to twice as many right angles as there are triangles, that is, as the figure has sides; but the sum of all the angles of the triangles is equal

equal to the sum of all the angles of the polygon, together with the sum of the angles at the point F, which last sum is equal to four right angles, (2 Cor. 4.) therefore the sum of all the angles of the polygon, together with four right angles, is equal to twice as many right angles as the figure has sides, and consequently the sum of the angles of the polygon is equal to twice as many right angles, wanting four, as the figure has sides.

Cor. The four interior angles of a quadrilateral are taken together equal to four right angles.

Theorem XXVI.

Fig. 42. The opposite sides of a parallelogram are equal, and the opposite angles are also equal.

Draw the diagonal BD; the two triangles ADB, DBC have the side BD common to both, and AB, DC being parallel, the angle ABD=BDC (21.) also AD, BC being parallel, the angle ADB=DBC, therefore the two triangles are equal (6.), and the side AB, opposite to the angle ADB, is equal to DC, opposite to the equal angle DBC. In like manner the third side AD is equal to the third side BC, therefore the opposite sides of a parallelogram are equal.

In the next place, because of the equality of the same triangles, the angle A is equal to the angle C, and also the angle ADC composed of the two angles ADB, BDC is equal to the angle ABC composed of the angles CBD, DBA; therefore the opposite angles of a parallelogram are also equal.

Theorem XXVII.

If the opposite sides of a quadrilateral ABCD are equal, so that AB=DC, and AD=BC; then the equal sides are parallel, and the figure is a parallelogram. Fig. 42.

Draw the diagonal BD. The two triangles ABD, CDB have the three sides of the one equal to the three sides of the other, each to each, therefore the triangles are equal (10.); and the angle ADB, opposite to AB, is equal to DBC opposite to DC, therefore the side AD is parallel to BC (22.). For a similar reason AB is parallel to DC; therefore the quadrilateral ABCD is a parallelogram.

Theorem XXVIII.

If two opposite sides AB, DC, of a quadrilateral are equal and parallel, the two other sides are in like manner equal and parallel; and the figure is a parallelogram. Fig. 42.

Draw the diagonal BD. Because AB is parallel to CD, the alternate angles ABD, BDC are equal, (21.); now the side AB=DC, and DB is common to the triangles ABD, BDC, therefore these triangles are equal, (5.) and hence the side AD=BC, and the angle ADB=DBC, consequently AD is parallel to BC, (22.) therefore the figure ABCD is a parallelogram.

SECT. II. OF THE CIRCLE.

Definitions.

Fig. I. A *Circle* is a plane figure contained by one line which is called the *circumference*, and is such, that all straight lines drawn from a certain point within the figure to the circumference, are equal to one another.

And this point is called the *centre* of the circle.

II. Every straight line CA, CE, CD, &c. drawn from the centre to the circumference, is called a *radius* or *semidiameter;* and every straight line, such as AB, which passes through the centre, and is terminated both ways by the circumference, is called a *diameter*.

Hence it follows that all the radii of a circle are equal, and all the diameters are also equal, each being the double of the radius.

III. An *Arch* of a circle is any portion of its circumference, as FHG.

The *chord* or *subtense* of an arch is the straight line FG which joins its extremities.

IV. A *Segment* of a circle is the figure contained by an arch, and its chord. If the figure be the half of the circle it is called a *Semicircle*.

Note. Every chord corresponds to two arches, and consequently to two segments; but in speaking of these, it is always the smallest that is meant, unless the contrary be expressed.

V. A *Sector* of a circle is the figure contained by an arch DE and the two radii CD, CE, drawn to the extremities of the arch. If the radii be at right angles to each other it is called a *Quadrant*.

VI. A straight line is said to be *placed* or *applied* in a circle, when its extremities are in the circumference of the circle as FG. Plate CCXLIII. fig. 115.

VII. A rectilineal figure is said to be *inscribed* in a circle when the vertices of all its angles are upon the circumference of the circle; in this case the circle is said to be *circumscribed* about the figure.

VIII. A straight line is said to *touch* a circle, or to be a *tangent* to a circle, when it meets the circumference in one point only; such, for example, is BD, fig. 49. The point A which is common to the straight line and circle, is called *the Point of Contact*.

IX. A polygon is said to be *described* or *circumscribed* about a circle when all its sides are tangents to the circle; and in this case the circle is said to be *inscribed* in the polygon. Fig. 118.

Theorem I.

Plate CCXLI. fig. 43.

Any diameter AB, divides the circle and its circumference into two equal parts.

For if the figure AEB be applied to AFB, so that the base AB may be common to both, the curve line AEB must fall exactly upon the curve line AFB; otherwise there would be points in the one or the other unequally distant from the centre, which is contrary to the definition of a circle.

Theorem

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Theorem II.

Fig. 44. Every chord is less than the diameter.

Let the radii CA, CD be drawn from the centre to the extremities of the chord AD; then the straight line AD is less than AC+CD, that is AD<AB.

Theorem III.

A straight line cannot meet the circumference of a circle in more than two points.

For if it could meet it in three, these three points would be equally distant from the centre, and therefore three equal straight lines might be drawn from the same point to the same straight line, which is impossible (2 cor. 15. 1.).

Theorem IV.

Fig. 45. In the same circle, or in equal circles, equal arches are subtended by equal chords, and, conversely, equal chords subtend equal arches.

If the radius AC be equal to the radius EO, and the arch AMD equal to the arch ENG; the chord AD shall be equal to the chord EG.

For the diameter AB being equal to the diameter EF, the semicircle AMDB may be applied exactly upon the semicircle ENGF, and then the curve line AMBD shall coincide entirely with the curve line ENGF, but the arch AMD being supposed equal to ENG, the point D must fall upon G, therefore the chord AD is equal to the chord EG.

Conversely, if the chord AD=EG, the arch AMD is equal to the arch ENG.

For if the radii CD, OG be drawn, the two triangles ACD, EOG have three sides of the one equal to three sides of the other, each to each, viz. AC=EO, CD=OG and AD=EG, therefore these triangles are equal, (10. 1.) and hence the angle ACD=EOG. Now if the semicircle ADB be placed upon EFG, because the angle ACD=EOG, it is evident that the radius CD will fall upon the radius OG, and the point D upon G, therefore the arch AMD is equal to the arch ENG.

Theorem V.

Fig. 45. In the same circle, or in equal circles, the greater arch is subtended by the greater chord, and, conversely, (if the arch be less than half the circumference) the greater chord subtends the greater arch.

For let the arch AH be greater than AD, and let the chords AD, AH, and the radii CD, CH be drawn. The two sides AC, CH, of the triangle ACH, are equal to the two sides AC, CD, of the triangle ACD; and the angle ACH is greater than ACD; therefore the third side AH is greater than the third side AD, (9. 1.) therefore the chord which subtends the greater arch is the greater. Conversely, if the chord AH be greater than AD, it may be inferred (cor. 9. 1.) from the same triangles that the angle ACH is greater than ACD, and that thus the arch AH is greater than AD.

Note. Each of the arches is here supposed less than half the circumference; if they were greater, the contrary property would have place, the arch increasing as the chord diminishes.

Theorem VI.

The radius CG, perpendicular to a chord AB, bisects the chord (or divides it into two equal parts), it also bisects the arch AGB subtended by the chord. Fig. 46.

Draw the radii CA, CB; these radii are two equal oblique lines in respect of the perpendicular CD, therefore they are equally distant from the perpendicular (15. 1.) that is AD=DB.

In the next place, because CG is perpendicular to the middle of AB, every point in CG is at equal distances from A and B, (16. 1.) therefore, if GA, GB be drawn, these lines are equal, and as they are the chords of the arches AG, BG, the arches are also equal. (4.).

Scholium.

Since the centre C, the middle D of the chord AB, and the middle G of the arch subtended by that chord, are three points situated in the same straight line perpendicular to that chord; and that two points in a straight line are sufficient to determine its position; it follows, that a straight line which passes through any two of these points must necessarily pass through the third; and must be perpendicular to the chord. It also follows, that a perpendicular to the middle of a chord passes through the centre, and the middle of the arch subtended by that chord.

Theorem VII.

If three points A, B, C, be taken in the circumference of a circle, no other circumference which does not coincide with the former, can be made to pass through the same three points. Fig. 47.

Let the chords AB, BC be drawn, and let OD, OF be drawn from the centre, perpendicular to, and consequently bisecting those chords. The centre of every circle passing through A and B must necessarily be somewhere in the perpendicular DO, (last theor.) and in like manner the centre of every circle passing through B and C, must be somewhere in the perpendicular OF, therefore the centre of a circle passing through A, B, and C, must be in the intersection of the perpendiculars DO, FO; and consequently can only be at one and the same point O; therefore, only one circle can be made to pass through the same three points A, B, C.

Cor. One circumference of a circle cannot intersect another in more than two points, for if they could have three common points they would have the same centre, and consequently would coincide with each other.

Theorem VIII.

Two equal chords are equally distant from the centre; Fig. 48.

centre; and of unequal chords, that which is nearer the centre is greater than that which is more remote.

Let the chord AB=DE, suppose the chords bisected by the perpendiculars CF, CG, from the centre, and draw the radii CA, CD. The right-angled triangles CAF, CDG have equal hypothenuses CA, CD; the side AF (=½AB) of the one is also equal to the side DG (=½DE) of the other, therefore, their remaining sides CF, CG (which are the distances of the chords from the centre) are equal (17. 1.).

Next let the chord AH be greater than DE; the arch AKH shall be greater than DME. Upon the arch AKH take ANB equal to DME; draw the chord AB, and suppose COF drawn from the centre perpendicular to AB, and CI perpendicular to AH. It is evident that CF>CO, and (15. 1.) CO>CI; much more then is CF>CI; but CF=CG, because the chords AB, DE are equal; therefore CG>CI; that is, the chord nearer the centre is greater than that which is farther from it.

Theorem IX.

Fig. 9. The perpendicular BD, drawn at the extremity of a radius CA, is a tangent to the circle.

For any oblique line CE is greater than the perpendicular CA, (15. 1.) therefore the point E is without the circle; therefore the line BD has but one point A common with the circumference, and consequently it is a tangent to the circle. (Def. 8.).

Scholium.

Through the same point A, only one tangent, AD, can be drawn to the circle. For if it be possible to draw another, let AG be that other tangent; draw CF perpendicular to AG; then CF shall be less than CA, (15. 1.) therefore F must be within the circle; and consequently AF when produced must necessarily meet the circle in another point besides A; therefore it cannot be a tangent.

Theorem X.

Fig. 5[illegible] and 5[illegible] If BC, the distance of the centres of two circles, be less than the sum of their radii; and also the greater radius less than the sum of the distance of their centres and the lesser radius; the two circles intersect each other.

For that the circles may intersect each other in a point A, it is necessary that the triangle ABC be possible; therefore, not only must CB be less than CA +AB, but also the greater radius AB must be less than AC+CB; (7. 1.) and it is evident, that as often as the triangle ABC can be constructed, the circumferences described on the centres B, C, shall intersect each other in two points A, D.

Theorem XI.

Fig. 52. If the distance CB of the centres of two circles be equal to the sum of the radii CA, BA, the circles shall touch each other externally.

It is evident that they have a common point A; but they cannot have more; for if they had two, then the distance of the centres must necessarily be less than the sum of the radii.

Theorem XII.

If the distance CB of the centres of two circles be equal to the difference of the radii, the two circles shall touch each other internally. Fig. 53.

In the first place, it is evident that the point A is common to them both; they cannot, however, have another; for that this may happen, it is necessary that the greater radius AB be smaller than the sum of the radius AC and the distance CB of the centre, (10.) which is not the case.

Cor. Therefore, if two circles touch each other, either internally or externally, their centres and the point of contact are in the same straight line.

Theorem XIII.

In the same circle, or in equal circles, equal angles ACB, DCE, at the centres, intercept upon the circumference equal arches AB, DE. And, conversely, if the arches AB, DE are equal, the angles ACB, DCE are equal. Fig. 54.

First, if the angle ACB be equal to DCE, the one angle may be applied upon the other; and as the lines containing them are equal, it is manifest that the point A will fall upon D, and the point B upon E; thus the arch AB will coincide with, and be equal to the arch DE.

Next, if the arch AB be equal to DE, the angle ACB is equal to DCE; for if the angles are not equal; let ACB be the greater; and let ACI be taken equal to DCE; then, by what has been already demonstrated, the arch AI=DE; but by hypothesis AB=DE; therefore, AI=AB which is impossible; therefore the angle ACB=DCE.

Theorem XIV.

The angle BCD at the centre of a circle is double the angle BAD at the circumference, when both stand on the same arch BD. Fig. 55. Fig. 56.

First let the centre of the circle be within the angle BAD; draw the diameter AE. The exterior angle BCE of the triangle BCA is equal to both the inward and opposite angles BAC, CBA; (23. 1.) but the triangle BCA being isosceles, the angle BAC=CBA; therefore the angle BCE is double of the angle BAC. For the same reason, the angle DCE is double of the angle DAE, therefore the whole angle BCD is double of the whole angle BAD. Fig. 55.

Suppose in the next place that the centre is without the angle BAD; then, drawing the diameter AE, it may be demonstrated, as in the first case, that the angle ECD is double of the angle EAD, and that the angle Fig. 56.

angle ECB, a part of the first, is double the angle EAB a part of the other; therefore the remaining angle BCD is double the remaining angle BAD.

Theorem XV.

Fig. 57. Fig. 58. All angles BAD, BFD in the same segment BAFD of a circle are equal to one another.

Fig. 57. If the segment be greater than a semicircle, from the centre C draw CB and CD; then the angles BAD and BFD being (by last theorem) each equal to half BCD, they must be equal to one another.

Fig. 58. But if the segment BAFD be less than a semicircle, let H be the intersection of BF and AD; then, the triangles ABH and FDH having the angle AHB of the one equal to FHD of the other, (4. 1.) and ABH =FDH, (by case 1.) will have the remaining angles of the one equal to the remaining angles of the other; that is the angle BAH=HFD, or BAD=BFD.

Theorem XVI.

Fig. 59. The opposite angles of any quadrilateral figure ABCD described in a circle are together equal to two right angles.

Draw the diagonals AC, BD; because the angle ABC=ACD, and CBD=CAD, (last theor.) the sum ABD+CBD=ACD+CAD; or ABC=ACD+CAD; to each of these equals add ADC, and ABC+ADC= ACD+CAD+ADC; but the last three angles being the angles of the triangle ADC, are taken together equal to two right angles, (24. 1.) therefore ABC+ADC= two right angles. In the same manner, the angles BAD, BCD may be shewn to be together equal to two right angles.

Theorem XVII.

Fig. 60. In a circle, the angle BAD in a semicircle is a right angle, but the angle ABD in a segment greater than a semicircle is less than a right angle; and the angle AED in a segment less than a semicircle is greater than a right angle.

Let C be the centre, join CA, and produce BA to F. Because CB=CA, the angle CAB=CBA; (11. 1.) and because CD=CA, the angle CAD =CDA, therefore the whole angle BAD=CBA +CDA; but these two last angles are together equal to DAF, (23. 1.) therefore the angle BAD=DAF; and hence each of them is a right angle.

And because ABD+ADB is a right angle, therefore ABD, an angle in a segment greater than a semicircle, is less than a right angle.

And because ABDE is a quadrilateral in a circle, the opposite angles B and E are equal to two right angles (last theor.), but B is less than a right angle; therefore the angle E, which is in a segment less than a semicircle, is greater than a right angle.

Theorem XVIII.

The angle BAC contained by AC, a tangent, and AB, a chord drawn from the point of contact, is equal to any angle ADB in the alternate segment of the circle. Fig. 61.

Draw the diameter AE, and join DE. The angles EAC, EDA, being right angles, (last theor.) are equal to one another; and of these, EAB, a part of the one, is equal to EDB, a part of the other (15.) therefore the remainder, BAC, of the former is equal to the remainder, BDA, of the latter.

SECT. III. OF PROPORTION.

Definitions.

I. When one magnitude contains another a certain number of times exactly, the former is said to be a *multiple* of the latter, and the latter a *part* of the former.

II. When several magnitudes are multiples of as many others, and each contains its parts the same number of times, the former are said to be *equimultiples* of the latter, and the latter *like parts* of the former.

III. Betwixt any two finite magnitudes of the same kind there subsists a certain relation in respect to quantity, which is called their *ratio*. The two magnitudes compared are called the *terms* of the ratio, the first the *antecedent*, and the second the *consequent*.

IV. If there be four magnitudes, or quantities, A, B, C, D, and if A contain some part of B just as often as C contains a like part of D, then, the ratio of A to B is said to be the same with (or equal to) the ratio of C to D.

It follows immediately from this definition, that if A contain B just as often as C contains D, then the ratio of A to B is equal to the ratio of C to D; for in that case it is evident that A will contain any part of B just as often as C contains a like part of D.

V. When two ratios are equal, their terms are called *proportionals*.

To denote that the ratio of A to B is equal to the ratio of C to D, they are usually written thus, A : B :: C : D, or thus, A : B=C : D, which is read thus; A is to B as C to D; such an expression is called an *analogy* or a *proportion*.

VI. Of four proportional quantities, the last term is called a *fourth proportional* to the other three taken in order.

VII. Three quantities A, B, C, are said to be proportionals, when the ratio of the first A to the second B is equal to the ratio of the second B to the third C.

VIII. Of three porportional quantities, the middle term is said to be a *mean proportional* between the other two, and the last a *third proportional* to the first and second.

IX. Quantities are said to be *continual proportionals*, when the first is to the second, as the second to the third, and as the third to the fourth, and so on.

X. When there is any number of magnitudes A, B, C, D, of the same kind, the ratio of the first A to the last D is said to be compounded of the ratio of A

Of Proportion.

A to B, and of the ratio of B to C, and of the ratio of C to D.

XI. If three magnitudes A, B, C, be continual proportionals; that is, if the ratio of A to B be equal to the ratio of B to C; then the ratio of the first A to the third C is said to be *duplicate* of the ratio of the first A to the second B. Hence, since by the last definition the ratio of A to C is compounded of the ratio of A to B and of B to C, a ratio which is compounded of two equal ratios is *duplicate* of either of them.

XII. If four magnitudes A, B, C, D be continual proportionals, the ratio of the first A to the fourth D is said to be *triplicate* the ratio of the first A to the second B. Hence a ratio compounded of three equal ratios is triplicate of any one of them.

XIII. *Ratio of Equality* is that which equal magnitudes bear to each other.

The next four definitions explain the names given by geometers to certain ways of changing either the order or magnitude of proportionals, so that they still continue to be proportional.

XIV. *Inverse Ratio* is when the antecedent is made the consequent, and the consequent the antecedent. See Theor. 3.

XV. *Alternate* proportion is when antecedent is compared with antecedent, and consequent with consequent. See Theor 2.

XVI. *Compounded* ratio is when the sum of the antecedent and consequent is compared either with the antecedent, or with the consequent. See Theor. 4.

XVII. *Divided* ratio is when the difference of the antecedent and consequent is compared either with the antecedent or with the consequent. See Theor. 4.

Axioms.

1. Equal quantities have each the same ratio to the same quantity; and the same quantity has the same ratio to each of any number of equal quantities.

2. Quantities having the same ratio to one and the same quantity, or to equal quantities, are equal among themselves; and those quantities, to which one and the same quantity has the same ratio, are equal.

3. Ratios equal to one and the same ratio are also equal, one to the other.

4. If two quantities be divided into, or composed of parts that are equal among themselves, or all of the same magnitude, then will the whole of the one have the same ratio to the whole of the other, as the number of parts in the one has to the number of equal parts in the other.

Theorem I.

Equimultiples of any two quantities have to each other the same ratio as the quantities themselves.

Let A and B be any two quantities, and, m being put to denote any number, let m A, m B be equimultiples of those quantities, m A shall have to m B the same ratio that A has to B.

Let the ratio of A to B be equal to the ratio of one number p to another number q, that is, let A contain p such equal parts as B contains q, (Ax. 4.) then, if x be put for one of those equal parts, we have

$$A=p\,x,\ B=q\,x,$$

and consequently, multiplying both by the same number m,

$$m\,A=m\,p\,x,\ m\,B=m\,q\,x,$$

or, which is evidently the same,

$$m\,A=p\times m\,x,\ m\,B=q\times m\,x.$$

Hence it appears that m A contains the quantity $m\,x$ as a part p times; and that m B contains the same quantity q times; therefore the ratio of m A to m B is the same as the ratio of the number p to the number q (Ax. 4.); but the ratio of A to B is also equal to the ratio of p to q, (by hypothesis), therefore the ratio of m A to m B is equal to the ratio of A to B (Ax. 3.).

Cor. Hence like parts of quantities have to each other the same ratio as the wholes: that is, $\frac{A}{m} : \frac{B}{m} :: A : B$; for A and B are equimultiples of $\frac{A}{m}$ and $\frac{B}{m}$.

Theorem II.

If four quantities of the same kind be proportionals, they shall also be proportionals by alternation.

Let A, B, C, D be four quantities, of the same kind, and let A : B :: C : D; then shall A : C :: B : D.

Let the equal ratios of A to B, and of C to D, be the same as the ratio of the number p to the number q; then A will contain p such equal parts as B contains q, (Ax. 4.) and C will, in like manner, contain p such equal parts as D contains q; let each of the equal parts thus contained in A and B be x, and let each of those contained in C and D be y, then

$$A=p\,x,\ B=q\,x,\ C=p\,y,\ D=q\,y.$$

Now as $A=p\,x$, and $C=p\,y$; it is manifest that A and C are equimultiples of x and y, therefore the ratio of A to C is equal to the ratio of x to y, (1.) and as $B=q\,x$, and $D=q\,y$, B and D are in like manner equimultiples of x and y; therefore the ratio of B to D is equal to the ratio of x to y; therefore the ratio of A to C is equal to the ratio of B to D.

Cor. If the first of four proportionals be greater than the third, the second is greater than the fourth; and if the first be less than the third, the second is less than the fourth.

Theorem III.

If four quantities be proportionals, they are also proportionals by inversion.

Let A : B :: C : D; then shall B : A :: D : C.

For let the equal ratios of A to B, and of C to D, be the same as the ratio of the number p to the number q, then as B will contain q such equal parts as A contains

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tains p (Ax. 4.), B will be to A as q is to p, and as D will contain q such equal parts as C contains p, D will be to C also as q to p, therefore the ratio of B to A is equal to the ratio of D to C (Ax. 3.).

Theorem IV.

If four quantities be proportionals, they are also proportionals by composition, and by division.

Let A : B :: C : D, then will
A+B : A :: C+D : C, and A+B : B :: C+D : D;
also A—B : A :: C—D : D, and A—B : B :: C—D : D.

Let us suppose, as in the two preceding theorems, that the ratios of A to B, and of C to D, are each equal to the ratio of the number p to the number q, so that A contains p such equal parts as B contains q, and C contains p such equal parts as D contains q; and let x as before denote each of the equal parts contained in A and B, and y each of the equal parts contained in C and D; then, since

$$A=px, \quad B=qx, \quad C=py. \quad D=qy,$$

therefore $A+B=px+qx=(p+q)x$;
$C+D=py+qy=(p+q)y$.

Now as A+B contains x $p+q$ times, and A contains the same quantity p times, and B contains it q times, (by the 4th axiom),

$$A+B : A :: p+q : p, \text{ and } A+B : B :: p+q : q,$$

and as C+D contains y $p+q$ times, and C contains it p times, and D contains it q times,

$$C+D : C :: p+q : p, \text{ and } C+D : D :: p+q : q.$$

Thus it appears that the ratios of A+B to A, and of C+D to C, are equal to the same ratio, namely, that of $p+q$ to p; therefore (Ax. 3.) A+B : A :: C+D : C. It also appears that the ratios of A+B to B, and C+D to D are each equal to the ratio of $p+q$ to q; therefore (Ax. 3.) A+B : B :: C+D : D.

In the same manner the second part of the theorem may be proved, namely, that
A—B : A :: C—D : C and A—B : B :: C—D : D.

Theorem V.

If four quantities be proportionals, and there be taken any equimultiples of the antecedents, and also any equimultiples of the consequents; the resulting quantities will still be proportionals.

Let A : B :: C : D, and m A, m C be any equimultiples of the antecedents, and n B, n D any equimultiples of the consequents; then m A : n B :: m C : n D.

The quantities p, q, x and y being supposed to express the same things as in the foregoing theorems; because

$$A=px, \quad B=qx, \quad C=py, \quad D=qy,$$

therefore, multiplying the antecedents by the number m, and the consequents by n,

$$mA=mpx, \quad nB=nqx,$$
$$mC=mpy, \quad nD=nqy,$$

and hence the ratio of m A to n B is equal to the ratio of the number mp to the number nq, (Ax. 4.) and the ratio of m C to n D, is equal to the same ratio of mp to nq, therefore (Ax. 3.) m A : n B :: m C : n D.

Theorem VI.

If there be any number of quantities, and as many others, which, taken two and two, have the same ratio; the first shall have to the last of the first series the same ratio which the first of the other series has to the last.

First, let there be three quantities A, B, C, and other three H, K, L, and let A : B :: H : K, and B : C :: K : L, then will A : C :: H : L.

A,	B,	C,
H,	K,	L

For let the equal ratios of A to B, and of H to K, be the same with the ratio of a number p to another number q, so that x and y being like parts of A and H, and also like parts of B and K, as in the former theorems,

$$A=px, B=qx, H=py, K=qy.$$

Also let C contain q equal parts, each equal to v, and let L contain q equal parts, each equal to z, so that

$$C=qv, \quad L=qz,$$

then because B : C :: K : L, that is, $qx : qv :: qy : qz$, and qx and qv are equimultiples of x and v, also qy and qz are equimultiples of y and z, therefore (1. & Ax. 3.) $x : v :: y : z$, hence (by last theorem) $px : qv :: py : qz$, that is, (because $A=px$, $C=qv$, $H=py$, $L=qz$) A : C :: H : L.

Next, let these four quantities, A, B, C, D, and other four H, K, L, M, such, that A : B :: H : K, and B : C :: K : L, and C : D :: L : M, then will A : D :: H : M.

A,	B,	C,	D,
H,	K,	L,	M.

For, because A : B :: H : K, and B : C :: K : L; therefore, by the first case, A : C :: H : L; and because C : D :: L : M, therefore by the same case, A : D :: H : M. The demonstration applies in the same manner to any number of quantities.

Cor. Hence it appears, that ratios compounded of the same number of like or equal ratios are equal to one another.

Note.—When four quantities are proportionals in the manner explained in this theorem, they are said to be so from *equality of distance*; and it is usual for mathematical writers to say that they are so, *ex æquali* or *ex æquo*.

Theorem VII.

If there be any number of quantities, and as many others, which taken two and two in a crofs order have the same ratio; the first shall have to the last of the first series the same ratio which the first has to the last of the other series.

First, let there be three quantities A, B, C, and other three H, K, L, such that A : B :: K : L, and B : C :: H : K; then will A : C :: H : L.

A, B, C,
H, K, L.

For let the equal ratios of A to B, and of K to L be equal to the ratio of the number p to the number q, so that as before.

$$A=p\,x,\ B=q\,x,\ K=p\,y,\ L=q\,y.$$

Also, let C be supposed to contain q equal parts, each equal to z, and let H contain p equal parts, each equal to v, so that

$$C=q\,z,\ H=p\,v;$$

Then, because B : C :: H : K, that is, $q\,x : q\,z :: p\,v : p\,y$; therefore (1. & Ax. 3.) $x : z :: v : y$, and consequently (5.) $p\,x : q\,z :: p\,v : q\,y$, that is (because $p\,x$ =A, $q\,z$=C, $p\,v$=H, $q\,y$=L) A : C :: H : L.

Next, let there be four quantities A, B, C, D, and other four H, K, L, M such, that A : B :: L : M, and B : C :: K : L, and C : D :: H : K, then will A : D :: H : M; for because A : B :: L : M, and B : C :: K : L; by the foregoing case A : C :: K : M; and again because C : D :: H : K; therefore, by same case, A : D :: H : M. The demonstration applies in the same manner to any number of quantities.

A, B, C, D,
H, K, L, M.

Note.—In this theorem, as in the last, the four quantities A, D, H, M, are said to be proportionals from *equality of distance;* but because in this case the proportions are taken in a cross order, it is common to say, that they are so, *ex æquali, in proportione perturbata*, or *ex æquo inversely.*

Theorem VIII.

If to the two consequents of four proportionals there be added any two quantities that have the same ratio to the respective antecedents, these sums and the antecedents will still be proportionals.

Let A : B :: C : D
and A : B′ :: C : D′

(where B′ and D′ denote two quantities distinct from those denoted by B and D); then will

$$A : B+B' :: C : D+D'.$$

For since A : B :: C : D, by inversion, (3.) B : A :: D : C, but A : B′ :: C : D′, therefore (6.) B : B′ :: D : D′, and by composition, (4.) and inversion B : B+B′ :: D : D+D′, and since A : B :: C : D; therefore (6.) A : B+B′ :: C : D+D′.

Cor. 1. If instead of two quantities B′, D′, there be any number B′, B″, &c. and D′, D″, &c. which taken two and two have the same ratio to the antecedents A, C, that is, if

$$A : B :: C : D,$$
$$A : B' :: C : D',$$
$$A : B'' :: C : D'';$$

then will A : B+B′+B″ :: C : C+D′+D″.

For since A : B+B′ :: C : D+D′ (by the theor.)
and A : B″ :: C : D″,

therefore, by the proposition,

$$A : B+B'+B'' :: C : D+D'+D''.$$

Cor. 2. If any number of quantities of the same kind be proportionals, as one of the antecedents is to its consequent, so is the sum of all the antecedents to the sum of all the consequents.

Let A : B :: C : D :: E : F,

then because A : A :: B : B,
and A : C :: B : D,
and A : E :: B : F;

therefore, A : A+C+E :: B : B+D+F; and by alternation,

$$A : B :: A+C+E : B+D+F.$$

In treating of proportion we have supposed that the antecedent contains some part of the consequent a certain number of times exactly, which part is therefore a common measure of the antecedent and consequent. But there are quantities which cannot have a common measure, and which are therefore said to be *incommensurable;* such, for example, are the sides of two squares, one of which has its surface double that of the other.

Although the ratio of two incommensurable quantities cannot be expressed in numbers, yet we can always assign a ratio in numbers which shall be as near to that ratio as we please. For let A and B be any two quantities whatever, and suppose that x is such a part of A that A=$p\,x$; then if q denote the number of times that x can be taken from B, and d the remainder, we have B=$q\,x+d$, and $q\,x$=B—d; and because $p : q :: p\,x : q\,x$, therefore $p : q$ :: A : B—d. Now as d is less than x, by taking x sufficiently small d may be less than any proposed quantity, so that B—d may differ from B by less than any given quantity; therefore two numbers p and q may always be assigned, such, that the ratio of p to q shall the same as the ratio of A to a quantity that differs less from B than by any given quantity, however small that quantity may be.

Hence we may conclude, that whatever has been delivered in this section relating to commensurable quantities, may be considered as applying equally to such as are incommensurable.

SECT. IV. THE PROPORTIONS OF FIGURES.

Definitions.

I. *Equivalent Figures* are such as have equal surfaces.

Two figures may be equivalent, although very dissimilar; thus a circle may be equivalent to a square, a triangle to a rectangle, and so of other figures.

We shall give the denomination of *equal* figures to those

Proportions of Figures. those which, being applied the one upon the other, coincide entirely; thus, two circles having the same radius are equal; and two triangles having three sides of the one equal to three sides of the other, each to each, are all equal.

II. Two figures are *similar*, when the angles of the one are equal to the angles of the other, each to each; and the *homologous* sides proportionals. The homologous sides are those which have the same position in the two figures; or which are adjacent to the equal angles. The angles themselves are called *homologous angles*.

Two equal figures are always similar, but similar figures may be very unequal.

III. In two different circles, *similar sectors*, *similar arches*, *similar segments*, are such as correspond to equal angles at the centre. Thus the angle A being equal to the angle O, the arch BC is similar to the arch DE, and the sector ABC to the sector ODE, &c. Fig. 62.

IV. The *Altitude of a parallelogram* is the perpendicular which measures the distance between the opposite sides or bases AB, CD. Fig. 63. Plate CCXLII.

V. The *Altitude of a triangle* is the perpendicular AD drawn from the vertical angle A upon the base BC. Fig. 64.

VI. The *Altitude of a trapezoid* is the perpendicular EF drawn between its two parallel bases AB, CD. Fig. 65.

VII. The *Area* and the surface of a figure are terms of nearly the same signification. The term *area*, however, is more particularly used to denote the superficial quantity of the figure in respect of its being measured, or compared with other surfaces.

Theorem I.

Fig. 66. Parallelograms which have equal bases and equal altitudes are equivalent.

Let AB be the common base of the parallelograms ABCD, EBAF, which being supposed to have the same altitude, the sides DC, FE opposite to the bases will lie in DE a line parallel to AB. Now, from the nature of a parallelogram, AD=BC, and AF=BE; for the same reason DC=AB, and FE=AB; therefore, DC=FE, and taking away DC and FE from the same line DE, the remainders CE and DF are equal; hence the triangles DAF, CBE have three sides of the one equal to three sides of the other, each to each; and consequently are equal (10. 1.). Now if from the quadrilateral ABED, the triangle ADF be taken away, there will remain the parallelogram ABEF; and if from the same quadrilateral ABED, the triangle CBE, equal to the former, be taken away, there will remain the parallelogram ABCD; therefore the two parallelograms ABCD, ABEF, which have the same base, and the same altitude, are equivalent.

Cor. Every parallelogram is equivalent to a rectangle of the same base and altitude.

Theorem II.

Fig. 67. Every triangle ABC is the half of a parallelogram ABCD, having the same base and altitude.

For the triangles ABC, ACD are equal (28. 1.).

Cor. 1. Therefore a triangle ABC is the half of a rectangle BCEF of the same base and altitude.

Cor. 2. All triangles having equal bases, and equal altitudes, are equivalent.

Theorem III.

Fig. 69. Two rectangles of the same altitude are to each other as their bases.

Let ABCD, AEFD be two rectangles, which have a common altitude AD; the rectangle ABCD shall have to the rectangle AEFD the same ratio that the base AB has to the base AE.

Let the base AB have to the base AE the ratio of the number p (which we shall suppose 7.) to the number q (which may be 4.) that is, let AB contain p (7.) such equal parts as AE contains q (4.), then, if perpendiculars be drawn to AB and AE at the points of division, the rectangles ABCD and AEFD will be divided, the former into p, and the latter into q rectangles, which will be all equal (1.) for they have equal bases, and the same altitude; thus the rectangle ABCD will also contain p such equal parts as the rectangle AEFD contains q; therefore the rectangle ABCD is to AEFD as the number p to the number q (Ax. 4. 3.), that is, as the base AB to AE.

Theorem IV.

Fig. 71. Any two rectangles are to each other as the products of any numbers proportional to their sides.

Let the numbers m, n, p, q, have among themselves the same ratios that the sides of the rectangles ABCD, AEFG have to each other; that is, let AB contain m such equal parts, whereof AD contains n, and AE contains p, and AF contains q; then shall ABCD : AEFG :: $m\,n : p\,q$.

Let the rectangles be so placed that the sides AB, AE may be in a straight line, then AD and AG will also lie in a straight line (3. 1.). Now (3.)

ABCD : AEHD :: AB : AE :: $m : p$,

but $m : p :: nm : np$, (1. 3.)

therefore ABCD : AEHD :: $nm : np$.

Again, AEHD : AEFG :: AD : AG :: $n : q$;

but $n : q :: pn : pq$;

therefore, AEHD : AEFG :: $pn : pq$;

and it was shewn that

ABCD : AEHD :: $nm : np$ or pn,

therefore, (6. 3.) ABCD : AEFG :: $mn : pq$.

Scholium.

Hence it appears, that the product of the base by the altitude of a rectangle may be taken for its measure, observing that by such product is meant that of the number of linear units in the base by the number of linear units in the altitude. This measure is however not absolute, but relative, for it must be supposed, that in comparing one rectangle with another, the sides of both are measured by the same linear unit. For example, if the base of a rectangle A be three units, and its altitude 10, the rectangle is represented by 3×10 or 30; this number considered by itself has no meaning,

Proportions of Figures.

meaning, but if we have a second rectangle B, the base of which is twelve units, and altitude seven, this second rectangle shall be represented by the number 12×7 or 84; and hence it may be concluded that the two rectangles are to each other as 30 to 84; therefore, if in estimating any superficies the rectangle A be taken for the measuring unit, the rectangle B shall have for its absolute measure $\frac{84}{30}$, that is, it shall be $\frac{84}{30}$ superficial units.

It is more common, as well as more simple, to take for a superficial unit a square, the side of which is an unit in length; and then the measure which we have regarded only as relative becomes absolute; for example the number 30, which is the measure of the rectangle A, represents 30 superficial units or 30 squares, each having its side equal to an unit. To illustrate this, see fig. 72.

Theorem V.

Fig.

The area of any parallelogram is equal to the product of its base by its altitude.

For the parallelogram ABCD is equivalent to the rectangle FBCE, which has the same base BC, and the same altitude AO (Cor. 1.); but the measure of the rectangle is $BC \times AO$, (4.) therefore the area of the parallelogram is $BC \times AO$.

Cor. Parallelograms having the same base, or equal bases, are to each other as their altitudes; and parallelograms having the same altitude are to each other as their bases; for in the former case put B for the common base and A and A′ for the altitudes, then the areas of the figures are $B \times A$ and $B \times A'$; and it is manifest that $B \times A : B \times A' :: A : A'$; and in the latter case, putting A for the common altitude, and B and B′ for the bases, it is evident that $B \times A : B' \times A :: B : B'$.

Theorem VI.

Fig. 6

The area of a triangle is equal to the product of its base by the half of its altitude.

For the triangle ABC is half of the parallelogram ABCD, which has the same base BC, and the same altitude AO (2.), but the area of the parallelogram is $BC \times AO$ (5.), therefore that of the triangle is $\frac{1}{2}$ BC $\times$AO, or $BC \times \frac{1}{2}$ AO.

Cor. Two triangles of the same altitude are to each other as their bases; and two triangles having the same base are to each other as their altitudes.

Theorem VII.

Fig. 7

The area of a trapezoid ABCD is equal to the product of its altitude EF by half the sum of its parallel sides AB, CD.

Through the point I, the middle of BC, draw KL parallel to the opposite side AD, and produce DC to meet KL. In the triangles IBL, ICK, IB is equal to IC by construction, and the angle CIK=BIL, and the angle ICK=IBL (21. 1.) therefore these triangles are equal; and hence the trapezoid ABCD is equivalent to the parallelogram ALKD, and has for its measure $AL \times EF$. But AL=DK, and because the triangle IBL is equal to the triangle KCI, the side BL=CK, therefore AB+CD=AL+DK=2AL; hence AL is half the sum of the parallel sides AB, CD; and as the area of the trapezoid is equal to $FE \times AL$, it is also equal to $FE \times \left(\frac{AB+CD}{2}\right)$.

Theorem VIII.

Fig. 69.

If four straight lines AB, AC, AD, AE, be proportionals; the rectangle ABFE, contained by the two extremes, is equivalent to the rectangle ACGD contained by the means. And conversely, if the rectangle contained by AB, AE, the extremes, be equivalent to the rectangle contained by AC, AD the means, the four lines are proportionals.

Let the rectangles be so placed as to have the common angle A, and let BF, DG intersect each other in H. Because the rectangles ABHD, ACGD have the same altitude AD,

ABHD : ACGD :: AB : AC; (3.),

and because the rectangles ABHD, ABFF have the same altitude AB, for the same reason

ABHD : ABFE :: AD : AE;

but by hypothesis AB : AC :: AD : AE, therefore (Ax. 3. 3.) ABHD : ACGD :: ABHD : ABFE, therefore (Ax. 2. 3.) the rectangle ACGD=ABFE.

Next suppose that the rectangle ACGD=ABFE; then ABHD : ACGD :: ABHD : ABFE, (Ax, 1. 3.) but ABHD : ACGD :: AB : AC, (3.) and ABHD : ABFE :: AD : AE, therefore AB : AC :: AD : AE.

Cor. If three straight lines be proportionals, the rectangle contained by the extremities is equal to the square of the mean; and if the rectangle contained by the extremes be equal to the square of the mean, the three straight lines are proportionals.

Theorem IX.

Fig. 70.

If four straight lines be proportionals, and also other four, the rectangles contained by the corresponding terms shall be proportionals; that is, if AB : BC :: CD : DE, and BF : BG :: DH : DI, then shall *rectangle* AF : *rect.* BM :: *rect.* CH : *rect.* DQ.

For in BG and DI, produced if necessary, take BF=BF, and DH=DH, and let FP be parallel to BC, and HN to DE; then (3.)

rect. AF : *rect.* BP :: AB : BC,
and *rect.* CH : *rect.* DN :: CD : DE;

but AB : BC :: CD : DE, (by hypothesis) therefore,

rect. AF : *rect.* BP :: *rect.* CH : *rect.* DN;

now (3.) *rect.* BP : *rect.* BM :: BF : BG, and *rect.* DN : *rect.* DQ :: DH : DI; but BF : BG :: DH : DI, (by hypoth.) therefore,

rect. BP : *rect.* BM :: *rect.* DN : *rect.* DQ;

but

Proportions of Figures. but it has been shewn that

rect. AF : rect. BP :: rect. CH : rect. DN,

therefore (6. 3.)

rect. AF : rect. BM :: rect. GH : rect. DQ.

Cor. Hence the squares of four proportional straight lines are themselves proportionals.

Theorem X.

Fig. 74. If a straight line AC be divided into any two parts at B, the square made upon the whole line AC shall be equal to the squares made upon the two parts AB, BC, together with twice the rectangle contained by those two parts: which may be expressed thus, $AC^2=AB^2+BC^2+2AB\times BC$.

Suppose the square ACDE to be constructed; take AF=AB, draw FG parallel to AC, and BH parallel to CD.

The square ACDE is made up of four parts; the first ABIF is the square upon AB, because AF=AB; the second IDGH is the square upon BC, for AC=AE, and AB=AF, therefore AC—AB=AE—AF, that is BC=EF; but BC=IG, and EF=DG, (26. 1.) therefore IGDH is the square upon BC, and the remaining two parts are the two rectangles BCGI, FEHI, which have each for their measure $AB\times BC$, therefore the square upon AC is equal to the squares upon AB and BC, and twice the rectangle $AB\times BC$.

Theorem XI.

Fig. 75. If a straight line AC be the difference of two straight lines AB, BC; the square made upon AC shall be equal to the excess of the two squares upon AB and BC above twice the rectangle contained by AB and BC; that is,

$$AC^2=AB^2+BC^2-2AB\times BC.$$

Construct the square ABIF, take AE=AC, and draw CG parallel to BI, and HK parallel to AB; and complete the square EFLK. The two rectangles CBIG, GLKD have each $AB\times BC$ for their measure; and if these be taken from the whole figure ABILKEA, that is from AB^2+BC^2, there will remain the square ACDE, that is, the square upon AC.

Theorem XII.

Fig. 76. The rectangle contained by the sum and the difference of two straight lines is equal to the difference of the squares upon those lines; that is,

$$(AB+BC)\times(AB-BC)=AB^2-BC^2.$$

Construct upon AB and AC the squares ABIF, ACDE; produce AB, so that BK=BC, and complete the rectangle AKLE. The base AK of the rectangle is the sum of the two lines AB, BC; and its altitude AE is the difference of the same lines; therefore, the rectangle AKLE=(AB+BC) (AB—BC); but the same rectangle is composed of two parts ABHE+BHLK, of which, BHLK is equal to the rectangle EDGF, for BH=DE, and BK=FE; therefore, AKLE=ABHE+EDGF; but these two parts constitute the excess of the square ABIF above the square DHIG, the former of which is the square upon AB, and the latter the square upon BC, therefore $(AB+BC)\times(AB-BC)=AB^2-BC^2$.

Theorem XIII.

Fig. The square upon the hypothenuse of a right-angled triangle is equal to the sum of the squares upon the two other sides.

Let ABC be a right-angled triangle; having formed the squares upon its three sides, draw a perpendicular AD from the right angle upon the hypothenuse, and produce it to E, and draw the diagonals AF, CH. The angle ABF is evidently the sum of ABC and a right angle, and the angle HBC is also the sum of ABC and a right angle; therefore the angle ABF=HBC; now AB=BH, for they are sides of the same square, and BC=BF for the same reason, therefore the triangles ABF, HBC have two sides, and the included angle of the one equal to two sides and the included angle of the other, each to each, therefore the triangles are equal (5. 1.) but the triangle ABF is the half of the rectangle BDEF (which for brevity's sake we shall call BE) because it has the same base BF, and the same altitude BD, (2.) and the triangle HBC is in like manner half of the square AH, for the angles BAC, BAL being both right angles, CA and AL constitute a straight line parallel to BH, (3. 1.) and thus the triangle HBC, and the square AH have the same base HB, and the same altitude AB; from which it follows that the triangle is half of the square (2). It has now been proved that the triangle ABF is equal to the triangle HBC; and that the rectangle BE is double of the former, and the square AH double of the latter; therefore the rectangle BE is equal to the square AH. It may be demonstrated in like manner that the rectangle CDEG, or CE, is equal to the square AI; but the rectangles BE, CE make up the square BCGF, therefore the square BCGF upon the hypothenuse is equal to the squares ALHB, AKIC upon the other two sides.

Theorem XIV.

Fig. In a triangle ABC, if the angle C is acute, the square of the opposite side AB is less than the squares of the sides which contain the angle C; and if AD a perpendicular be drawn to BC from the opposite angle, the difference shall be equal to twice the rectangle $BC\times CD$; that is,

$$AB^2=AC^2+CB^2-2BC\times CD.$$

First. Suppose AD to fall within the triangle, then BD=BC—CD, and consequently (11.) $BD^2=BC^2+CD^2-2BC\times CD$; to each of these equals add AD^2; then, observing that $BD^2+DA^2=BA^2$, and $CD^2+DA^2=CA^2$,

$$AB^2=BC^2+CA^2-2BC\times CD.$$

Next, suppose AD to fall without the triangle, so that BD=CD—BC, and therefore $BD^2=CD^2+BC^2-2BC\times CD$, (11.) to each of these add AD^2 as before,

before, and we get

$$AB^2 = BC^2 + CA^2 - 2BC \times CD.$$

Theorem XV.

In a triangle ABC, if the angle C is obtuse, the square of the opposite side AB is greater than the sum of the squares of the sides which contain the angle C; and if AD a perpendicular be drawn to BC from the opposite angle, the difference shall be equal to twice the rectangle $BC \times CD$, that is,

$$AB^2 = AC^2 + BC^2 + 2BC \times CD$$

For $BD = BC + CD$, and therefore (10.) $BD^2 = BC^2 + CD^2 + 2BC \times CD$; to each of these equals add AD^2, then, observing that $AD^2 + DB^2 = AB^2$, and $AD^2 + DC^2 = AC^2$,

$$AB^2 = BC^2 + CA^2 + 2BC \times CD.$$

Scholium.

It is only when a triangle has one of its angles a right angle, that the sum of the squares of two of its sides can be equal to the squares of the third side; for if the angle contained by those sides be acute, the sum of their squares is greater than the square of the opposite side, and if the angle be obtuse, that sum is less than the square of the opposite side.

Theorem XVI.

Fig.

If a straight line AE be drawn from the vertex of any triangle ABC to the middle of its base BC; the sum of the squares of the sides is equal to twice the square of half the base, and twice the square of the line drawn from the vertex to the middle of the base; that is, $AB^2 + AC^2 = 2BE^2 + 2AE^2$;

Draw AD perpendicular to BC, then

$$AB^2 = BE^2 + EA^2 - 2BE \times ED, \ (14.)$$
$$\text{and } AC^2 = CE^2 + EA^2 + 2CE \times ED, \ (15.)$$

therefore, by adding equals to equals, and observing that $BE = CE$, and therefore $BE^2 = CE^2$, and $2BE \times ED = 2CE \times ED$,

$$AB^2 + AC^2 = 2BE^2 + 2AE^2.$$

Theorem XVII.

Fig.

A straight line DE drawn parallel to one of the sides of a triangle ABC divides the other two sides AB, AC proportionally, so that AD : DB :: AE : EC.

Join BE and CD. The triangles BDE, CDE, having the same base DE, and the same altitude, are equivalent, (2) and the triangles ADE, BDE, having the same altitude, are to one another as their bases, (6.) that is, ADE : BDE :: AD : DB; the triangles ADE, CDE, having also the same altitude, are to one another as their bases; that is, ADE : CDE :: AE : EC, but the triangle BDE has been proved equal to CDE; therefore, because of the common ratio in the two proportions, we have (Ax. 3.)

AD : DB :: AE : EC.

Cor. Hence by composition AB : AD :: AC : AE; and AB : BD :: AC : CE.

Theorem XVIII.

Conversely, if two of the sides AB, AC of a triangle are divided proportionally by the straight line DE, so that AD : DB :: AE : EC, then shall the line DE be parallel to the remaining side BC. Fig. 81.

For if DE is not parallel to BC, suppose some other line DO to be parallel to BC; then, AB : BD :: AC : CO (17.); and since by hypothesis AD : DB :: AE : EC, and consequently, by composition, AE : BD :: AC : CE, therefore, AC : CO :: AC : CE; therefore, CO=CE (2 Ax. 3.) which is impossible; therefore DO is not parallel to BC.

Cor. If it be supposed that BA : AD :: CA : AE, still DE will be parallel to BC; for by division BD : AD :: CE : AE, this proportion being the same as in the Theorem, the conclusion must be the same.

Theorem XIX.

A straight line AD, which bisects the angle BAC of a triangle, divides the base BC into two segments proportional to the adjacent sides BA, AC; that is, BD : DC :: BA : AC. Fig. 82.

Through the point C draw CE parallel to AD, so as to meet BA produced. In the triangle BCE, the line AD is parallel to one of its sides CE, therefore BD : DC :: BA : AE; now the triangle CAE is isosceles, for, because of the parallels AD, CE, the angle ACE=DAC, and the angle AEC=BAD, (21. 1.) but by hypothesis DAC=BAD; therefore ACE=AEC; and consequently AE=AC, (12. 1.) therefore, substituting AC instead of AE in the above proportion, it becomes BD : DC :: BA : AC.

Theorem XX.

If two triangles be equiangular, their homologous sides are proportional, and the triangles are similar. Fig. 84.

Let ABC, CDE be two equiangular triangles, which have the angle BAC=CDE, ABC=DCE, and ACB=DEC; the homologous sides, or the sides adjacent to the equal angles, shall be proportional; that is, BC : CE :: AB : CD :: AC : DE.

Place the homologous sides BC, CE in the same direction, and produce the sides BA, ED, till they meet in F. Because BCE is a straight line, and the angle BCA is equal to CED, the lines CA, EF are parallel, (22. 1.) and in like manner, because the angle ABC=DCE, the lines BF, CD are parallel; therefore the figure ACDF is a parallelogram, and hence AF=CD, and CA=DF (26. 1.). In the triangle BFE the line AC is parallel to the side FE, therefore BC :

Proportions of Figures.

BC : CE :: BA : AF; or since AF=CD, BC : CE :: BA : CD. Again, in the same triangle, because CD is parallel to the side BF, BC : CE :: FD : DE, or, since FD=AC, BC : CE :: AC : DE; having now shewn that BC : CE :: BA : CD, and that BC : CE :: AC : DE, it follows that BA : CD :: AC : DE; therefore the equiangular triangles BAC, CDE have their homologous sides proportional, and hence (def. 2.) the triangles are similar.

Scholium.

It is manifest, that the homologous sides are opposite to the equal angles.

Theorem XXI.

Fig. 83. If two triangles have their homologous sides proportional, they are equiangular and similar.

Suppose that BC : EF :: AB : DE :: AC :: DF; then shall A=D, B=E, C=F. At the point E make the angle FEG=B, and at the point F make EFG=C; then the third angle G shall be equal to the third angle A, and the two triangles ABC, GEF shall be equiangular; therefore, by the last theorem BC : EF :: AB : GE; but by hypothesis BC : EF :: AB : DE, therefore GE=DE (Ax. 2. 3.). In like manner, because by the same theorem BC : EF :: CA : FG; and by hypothesis BC : EF :: CA : FD; therefore FG=FD; but it was shewn that EG=ED, therefore, the triangles GEF, DEF, having the sides of the one equal to those of the other, each to each, are equal, but, by construction, the triangle GEF is equiangular to ABC therefore also the triangles DEF, ABC are equiangular and similar.

Theorem XXII.

Fig. 85. Two triangles which have an angle of the one equal to an angle of the other, and the sides about these angles proportional, are similar.

Let the angle A=D, and let AB : DE :: AC : DF, the triangle ABC is similar to DEF. Take AG=DE, and draw GH parallel to BC, then the angle AGH=ABC, (21. 1.) therefore the triangle AGH is equiangular to ABC, and consequently (20.) AB : AG :: AC : AH; but by hypothesis AB : DE :: AC : DF, and by construction AG=DE, therefore AH=DF; the two triangles AGH, DEF are therefore equal, (5. 1.) but the triangle AGH is similar to ABC, therefore DEF is similar to ABC.

Theorem XXIII.

Fig. 86. In a right-angled triangle, if a perpendicular AD be drawn from the right angle upon the hypothenuse, then,

1. The triangles ABD, CAD on each side of the perpendicular are similar to the whole triangle BAC, and to one another.
2. Each side AB or AC is a mean proportional between the hypothenuse BC, and the adjacent segment BD or DC.
3. The perpendicular AD is a mean proportional between the two segments BD, DC.

1. The triangles BAD, BAC have the common angle B; besides, the right angle BAC is equal to the right angle BDA, therefore the third angle BAD of the one, is equal to the third angle BCA of the other; therefore, these triangles are equiangular and similar; and in the same manner it may be shewn, that the triangle DAC is equiangular and similar to BAC; therefore the three triangles are equiangular and similar to each other.

2. Because the triangle BAD is similar to the triangle BAC, their homologous sides are proportional. Now the side BD of the lesser triangle is homologous to the side BA of the greater, because they are opposite to the equal angles BAD, BCA; in like manner BA, considered as a side of the lesser triangle, is homologous to the side BC of the greater, each being opposite to a right angle; therefore, BD : BA :: BA : BC. In the same manner it may be shewn that CD : CA :: CA : CB, therefore each side is a mean proportional between the hypothenuse and the segment adjacent to that side.

3. By comparing the homologous sides of the two similar triangles ABD, ACD, it appears that BD : DA :: DA : DC; therefore the perpendicular is a mean proportional between the segments of the hypothenuse.

Theorem XXIV.

Fig. 8[illegible] Two triangles, which have an angle of the one equal to an angle of the other, are to each other as the rectangles of the sides which contain the equal angles; that is, the triangle ABC is to the triangle ADE, as the rectangle $AB \times AC$ to the rectangle $AD \times AE$.

Join BE; because the triangles ABE, ADE have a common vertex E, they have the same altitude, therefore ABE : ADE :: AB : AD, (Cor. to 6.); but AB : AD :: $AB \times AE$: $AD \times AE$, (3.) therefore,

$$ABE : ADE :: AB \times AE : AD \times AE.$$

In the same manner it may be demonstrated that

$$ABC : ABE :: AB \times AC : AB \times AE;$$

Therefore (6. 3.) $ABC : ADE :: AB \times AC : AD \times AE$.

Cor. Therefore the two triangles are equivalent, if the rectangle $AB \times AC = AD \times AE$, or (8.) if AB : AD :: AE : AC, in which case, the sides about the equal angles are said to be *reciprocally* proportional.

Scholium.

What has been proved of triangles is also true of parallelograms, they being the doubles of such triangles.

Theorem XXV.

Fig 85 Two similar triangles are to each other as the squares of their homologous sides.

Let

Proportions of Figures.

Let the angle A=D, the angle B=E, and therefore the angle C=F,

then (20.) AB : DE :: AC : DF;

now AB : DE :: AB : DE,

for the two ratios are identical, therefore (9.)

$AB^2 : DE^2 :: AB \times AC : DE \times DF$;

but ABC : DEF :: $AB \times AC : DE \times DF$, (24.)

therefore ABC : DEF :: $AB^2 : DE^2$, (Ax. 3. 3.)

therefore the two similar triangles ABC, DEF, are to each other as the squares of the homologous sides AB, DE, or as the squares of any of the other homologous sides.

Theorem XXVI.

Fig. 89. Similar polygons are composed of the same number of triangles which are similar and similarly situated.

In the polygon ABCDE, drawn from one of the angles A the diagonals AC, AD to all the other angles. In the polygon FGHIK, draw in like manner from the angle F, homologous to A, the diagonals FH, FI to the other angles.

Because the polygons are similar, the angle ABC is equal to its homologous angle FGH (Def. 2.) also the sides AB, BC are proportional to FG, GH, so that AB : FG :: BC : GH, therefore the triangles ABC, FGH are similar (22.); therefore the angle BCA=GHF, and these being taken from the equal angles BCD, GHI, the remainders ACD, FHI are equal; but the triangles ABC, FGH being similar, AC : FH :: BC : GH, besides, because of the similarity of the polygons, BC : GH :: CD :: HI; therefore AC : FH :: CD : HI; now it has been already shewn that the angle ACD=FHI, therefore the triangles ACD, FHI are similar (22.). It may be demonstrated in the same manner that the remaining triangles are similar, whatever be the number of sides of the polygon; therefore two similar polygons are composed of the same number of triangles, similar to each other, and similarly situated.

Theorem XXVII.

Fig. [illegible] The perimeters of similar polygons are as the homologous sides, and the polygons themselves, are as the squares of the homologous sides.

For, since by the nature of similar figures AB : FG :: BC : GH :: CD : HI, &c. therefore, (2. cor. 8. 3.) AB+BC+CD, &c. the perimeter of the first figure, is to FG+GH+HI, &c. the perimeter of the second, as the side AB to its homologous side FG.

Again, because the triangles ABC, FGH are similar, ABC : FGH :: $AC^2 : FH^2$ (25.), in like manner ACD : FHI :: $AC^2 : FH^2$, therefore,

ABC : FGH :: ACD : FHI.

By the same manner of reasoning,

ACD : FHI :: ADE : FIK,

and so on if there be more triangles; hence, from this series of equal ratios, it follows (2. cor. 8. 3.) that ABC+ACD+ADE, or the polygon ABCDE, is to FGH+FHI+FIK, or the polygon FGHIK, as one of the antecedents ABC is to its consequent FGH, or as AB^2 to FG^2; therefore, similar polygons are to each other as the squares of their homologous sides.

Cor. 1. If three similar figures have their homologous sides equal to the three sides of a right-angled triangle, the figure having the greatest side shall be equal to the two others; for these three figures are proportional to the squares of their homologous sides, and the square of the hypothenuse is equal to the squares of the other two sides.

Cor. 2. Similar polygons have to each other the duplicate ratio of their homologous sides. For let L be a third proportional to the homologous sides AB, FG, then (def. 11. 3.) AB has to L the duplicate ratio of AB to FG; but AB : L :: $AB^2 : AB \times L$ (3.), or, since $AB \times L = FG^2$, (cor. to 8.) AB : L :: $AB^2 : FG^2$ :: ABCDE : FGHIK, therefore the figure ABCDE has to the figure FGHIK, the duplicate ratio of AB to FG.

Theorem XXVIII.

The segments of two chords AB, CD, which cut each other within a circle, are reciprocally proportional, that is AO : DO :: CO : OB. Fig. 88.

Join AC and BD; and because the triangle AOC, BOD have the angles at O equal (4. 1.), and the angle A=D and the angle C=B (15. 2.) the triangles are similar; therefore the homologous sides are proportional, (20.) that is, AO : DO :: CO : BO.

Cor. Hence $AO \times BO = CO \times DO$, (8.) that is, the rectangle contained by the segments of the one chord is equal to the rectangle contained by the segments of the other.

Theorem XXIX.

If from a point O without a circle, two straight lines be drawn, terminating in the concave arch BC; the whole lines shall be reciprocally proportional to the parts of them without the circle, that is OB : OC :: OD : OA. Fig. 90.

Join AC, BD; then the triangles OAC, OBD have the common angle O, also the angle B=C (15. 2.), therefore the triangles are similar, and the homologous sides are proportional, that is, OB : OC :: OD : OA.

Cor. Therefore (8.) $OA \times OB = OC \times OD$, that is, the rectangles contained by the whole lines, and the parts of them without the circle, are equal to one another.

Theorem XXX.

If from a point O without a circle a straight line OA be drawn touching the circle, and also a straight line OC cutting it, the tangent shall be a mean proportional between the whole line which Fig. 91.

Problems.

which cuts the circle, and the part of it without the circle, that is, OC : OA :: OA : OD.

For if AC, AD be joined, the triangles OAD, OCA, have the angle at O common to both, also the angle ACD or ACO is equal to DAO (18. 2.), therefore the triangles are similar (20.), and consequently CO : OA :: OA : OD.

Cor. Therefore (cor. to 8.) $CO \times OD = OA^2$, that is, the square of the tangent is equal to the rectangle contained by the whole line which cuts the circle, and the part of it without the circle.

Theorem XXXI.

Fig. 92. In the same circle, or in equal circles, any angles ACB, DEF are to each other as the arches AB, DF of the circles intercepted between the lines which contain the angles.

Suppose the arch AB to have to the arch DF the ratio of the number p to the number q; then the arch AB being supposed divided into equal parts A g, g h, h B, the number of which is p, the arch DF shall contain q equal parts D k, kl, lm, mn, n F, each of which is equal to any one of the equal parts into which AB is divided. Draw straight lines from the centres of the circles to the points of division, these lines will divide ACB into p angles and DEF into q angles, which are all equal (13. 2.) therefore, the angle ACB has to the angle DEF the ratio of the number p to the number q, which ratio is the same as that of the arch AB to the arch DF.

Cor. Hence it appears that angles may be measured and compared with each other by means of arches of circles described on the vertices of the angles as centres, observing, however, that the radii of the circles must be equal.

SECT. V. PROBLEMS.

Problem I.

Plate CCXLIII. fig. 93. To bisect a given straight line AB; that is, to divide it into two equal parts.

From the points A and C as centres, with any radius greater than the half of AB, describe arches, cutting each other in D and D on each side of the line AB. Draw a straight line through the points D, D, cutting AB in C; the line AB is bisected in C.

For the points D, D, being equally distant from the extremities of the line AB, are each in a straight line perpendicular to the middle of AB, (16. 1.), therefore the line DCD is that perpendicular, and consequently C is the middle of AB.

Problem II.

Fig. 94. To draw a perpendicular to a given straight line BC, from a given point A in that line.

Take the points B and C at equal distances from A; and on B and C as centres, with any radius greater than BA, describe arches, cutting each other in D; draw a straight line from A through D, which will be the perpendicular required. For the point D, being at equal distances from the extremities of the line BC, must be in a perpendicular to the middle of BC (16. 1.), therefore AD is the perpendicular required.

Problem III.

Fig. 95. To draw a perpendicular to a given line, BD, from a given point A without that line.

On A as a centre, with a radius sufficiently great, describe an arch, cutting the given line in two points B, D; and on B and D as centres, with a radius greater than the half of BD, describe two arches, cutting each other in E; draw a straight line through the points A and E, meeting BD in C; the line AC is the perpendicular required.

For the two points A and E are each at equal distances from B and D; therefore, a line passing through A and E is perpendicular to the middle of BD, (16. 1.).

Problem IV.

At a given point A, in a given line AB, to make an angle equal to a given angle K. Fig. 96.

On K as a centre, with any radius, describe an arch to meet the lines containing the angle K, in L and I; and on A as a centre, with the same radius, describe an indefinite arch BO; on B as a centre, with a radius equal to the chord LI, describe an arch, cutting the arch BO in D; draw AD, and the angle DAB shall be equal to K.

For the arches BD, LI having equal radii and equal chords, the arches themselves are equal (4. 2.), therefore the angles A and K are also equal (13. 2.).

Problem V.

To bisect a given arch AB, or a given angle C. Fig. 97.

First. To bisect the arch AB, on A and B as centres, with one and the same radius, describe arches to intersect in D; join CD, cutting the arch in E, and the arch AE shall be equal to EB.

For, since the points C and D are at equal distances from A, and also from B, the line which joins them is perpendicular to the middle of the chord AB (16. 1.), therefore, the arch AB is bisected at E, (6. 2.).

Secondly. To bisect the angle C; on C as a centre, with any distance, describe an arch, meeting the lines containing the angle in A and B; then find the point D

Problems. D as before, and the line CD will manifestly bisect the angle C, as required.

Scholium.

By the same construction we may bisect each of the arches AE, EB; and again we may bisect each of the halves of these arches, and so on; thus by successive subsivisions, an arch may be divided into four, eight, sixteen parts, &c.

Problem VI.

Fig. 98. Through a given point A, to draw a straight line parallel to a given straight line BC.

On A as a centre, with a radius sufficiently large, describe the indefinite arch EO; on E for a centre, with the same radius, describe the arch AF; in EO take ED equal to AF, draw a line from A through D, and AD will be parallel to BC.

For if AE be joined, the angle EAD is equal to AEB (13. 2.), and they are alternate angles, therefore AD is parallel to BC, (22. 1.).

Problem VII.

Fig. 99. To construct a triangle, the sides of which may be equal to three given lines A, B, C.

Take a straight line, DE, equal to one of the given lines A; on D as a centre, with a radius equal to another of the lines B, describe an arch; on E as a centre, with a radius equal to the remaining line C, describe another arch, cutting the former in F; join DF and EF, and DEF will be the triangle required, as is sufficiently evident.

Scholium.

It is necessary that the sum of any two of the lines be greater than the third line (7. 1.).

Problem VIII.

Fig. 100. To construct a parallelogram, the adjacent sides of which may be equal to two given lines A, B, and the angle they contain equal to a given angle C.

Draw the straight line DE=A; make the angle GDE=C, and take DG=B; describe two arches, one on G as a centre, with a radius GF=DE, and the other on E, with a radius EF=DG, then DEFG shall be the parallelogram required.

For by construction the opposite sides are equal, therefore, the figure is a parallelogram, (27. 1.) and it is so constructed, that the adjacent sides and the angle they contain have the magnitudes given in the problem.

Cor. If the given angle be a right angle, the figure will be a rectangle; and if the adjacent sides be also equal, the figure will be a square.

Problem IX.

To find the centre of a given circle, or of a circle of which an arch is given. Fig. 101.

Take any three points A, B, D, in the circumference of the circle, or in the given arch, and having drawn the straight lines AB, BD, bisect them by the perpendiculars EG, FH; the point C where the perpendiculars intersect each other is the centre of the circle, as is evident from Theorem VI. sect. 2.

Scholium.

By the very same construction a circle may be found that shall pass through three given points A, B, C; or that shall be described about a given triangle ABC.

Problem X.

To draw a tangent to a given circle through a given point A. Fig. 102. 103.

If the given point A be in the circumference (fig. 102), draw the radius AC; and through A, draw AD perpendicular to AC, and AD will be a tangent to the circle, (9. 2.). But if the given point A be without the circle, (fig. 103.) draw AC to the centre, and bisect AC in O, and on O as a centre, with OA or OC as a radius, describe a circle which will cut the given circle in two points D and D′; join AD and AD′, and each of the lines AD, AD′, will be a tangent to the circle.

For, draw the radii CD, CD′, then each of the angles ADC, AD′C is a right angle, (17. 2.); therefore AD and AD′ are both tangents to the circle, (9. 2.).

Cor. The tangents AD, AD′ are equal to one another, (17. 1.)

Problem XI.

To inscribe a circle in a given triangle ABC. Fig. 104.

Bisect A and B any two angles of the triangle by the straight lines AO, BO, which meet each other in O; from O draw OD, OE, OF, perpendiculars to its sides; these lines shall be equal to one another.

For in the triangles ODB, OEB, the angles ODB =OEB, and the angle OBD=OBE; therefore the remaining angles BOD, BOE, are equal; and as the side DB is common to both triangles, they are equal to one another, (6. 1.), therefore the side OD=OE; in the same manner it may be demonstrated, that OD =OF; therefore the lines OD, OE, OF, are equal to one another, and consequently a circle described on O as a centre, with OD as a radius, will pass through E and F; and as the sides of the triangle are tangents to the circle, (9. 2.) it will be inscribed in the triangle.

Problem XII.

Upon a given straight line AB, to describe a seg- Fig. 105.

ment

Problems.

ment of a circle that may contain an angle equal to a given angle C.

PRODUCE AB towards D, and at the point B make the angle DBE equal to the given angle C; draw BO perpendicular to BE, and GO perpendicular to the middle of AB, meeting BO in O; on O as a centre, with OB as a radius, describe a circle, which will pass through A, and AMB shall be the segment required.

For since FE is perpendicular to BO, FE is a tangent to the circle, therefore the angle EBD (which is equal to C by construction) is equal to any angle AMB in the alternate segment, (18. 2.).

PROBLEM XIII.

Fig. 106. Fig. 107. To divide a straight line, AB, into any propofed number of equal parts; or into parts having to each other the same ratios that given lines have.

FIRST, Let it be proposed to divide the line AB, (fig. 106.) into five equal parts. Through the extremity A draw an indefinite line AG, take AC of any magnitude, and take CD, DE, EF, and FG, each equal to AC, that is, take AG equal to five times AC; join GB, and draw CI parallel to GB, the line AI shall be one-fifth part of AB, and AI being taken five times in AB, the line AB shall be divided into five equal parts.

For since CI is parallel to GB, the sides AG and AB are cut proportionally in C and I; but AC is the fifth part of AG; therefore AI is the fifth part of AB.

Next, let it be proposed to divide AB (fig. 107.) into parts, having to each other the ratios that the lines P, Q, R, have. Through A draw AG, and in AG take AC=P, CD=Q, DE=R; join EB, and draw CI and DK parallel to EB; the line AB shall be divided as required.

For, because of the parallels CI, DK, EB, the parts AI, IK, KB, have to each other the same ratios that the parts AC, CD, DE have, (17. 4.) which parts are by construction equal to the given lines P, Q, R.

PROBLEM XIV.

Fig. 108. To find a fourth proportional to three given lines, A, B, C.

DRAW two straight lines DE, DF, containing any angle; on DE take DA=A, and DB=B, and on DF take DC=C; join AC, and draw BX parallel to AC; then, BX shall be the fourth proportional required.

For, because BX is parallel to AC, DA : DB :: DC : DX (17. 4.) that is, A : B :: C : DX, therefore DX is a fourth proportional to A, B, and C.

COR. The same construction serves to find a third proportional to two lines A and B; for it is the same as a fourth proportional to the lines A, B, and C.

PROBLEM XV.

Fig. 109. To find a mean proportional between two straight lines, A, B.

UPON any straight line DF take DE=A, and EF =B; and on DF as a diameter describe a semicircle DGF; draw EG perpendicular to DF, meeting the circle in G; the line EG shall be the mean proportional required.

For, if DG, FG, be joined, the angle DGF is a right angle, (17. 2.) therefore, in the right-angled triangle DGF, GE is a mean proportional between DE and EF, (23. 4.).

PROBLEM XVI.

To divide a given straight line AB into two parts, so that the greater may be a mean proportional between the whole line and the other part. Fig. 11[0].

AT B, one of the extremities of the line, draw BC perpendicular to AB, and equal to the half of AB; on C as a centre, with CB as a radius, describe a circle; join AC, meeting the circle in D; make AF= AD, and AB shall be divided at F in the manner required.

For since AB is perpendicular to the radius, it is a tangent to the circle (9. 2.), and if AC be produced to meet the circle in E, AB : AF :: AE : AB, (30. 4.) and by division, AB—AF : AF :: AE—AB : AB; but AB—AF=BF, and since DE=2BC=AB, therefore AE—AB=AD=AF, therefore BF : AF :: AF : AB.

SCHOLIUM.

When a line is divided in this manner it is said to be divided in *extreme and mean ratio*.

PROBLEM XVII.

To make a square equivalent to a given parallelogram or to a given triangle. Fig. 112. Fig. 113.

FIRST, Let ABCD be a given parallelogram, (fig. 112.) the base of which is AB, and altitude DE; find XY a mean proportional between AB and DE, (by problem 15.) and XY shall be the side of the square required.

For since by construction AB : XY :: XY : DE, therefore, $XY^2=AB\times DE$ (8. 4.) = parallelogram ABCD (5. 4.).

Next, let ABC be a given triangle (fig. 113.) BC its base, and AD its altitude; find XY a mean proportional between half the base and the altitude, and XY shall be the side of the square required.

For since $\frac{1}{2}$BC : XY :: XY : AD; therefore (8. 4.) $XY^2=\frac{1}{2}BC\times AD$=triangle ABC (6. 4.).

PROBLEM XVIII.

Upon a given line EF, to construct a rectangle EFGX equivalent to a given rectangle ABCD. Fig. 11[4].

FIND a fourth proportional to the three lines EF, AB and AD; (by problem 14.) draw EX, perpendicular to EF, and equal to that fourth proportional, and complete the rectangle EFGX, which will have the magnitude required.

For since EF : AB :: AD : EX, therefore (8. 4.) $EF\times EX=AB\times AD$, that is, the rectangle EFGX is equal to the rectangle ABCD.

PROBLEM

Problems.

Problem XIX.

Fig. 1.

To make a triangle equivalent to a given polygon ABCDE.

First, draw the diagonal CE, so as to cut off the triangle CDE; draw DG parallel to CE, to meet AE produced in G; join CG, and the given polygon ABCDE shall be equivalent to another polygon ABCG which has one side fewer.

For since DG is parallel to CE, the triangle CGE is equivalent to the triangle CDE, (2. cor. 2. 4.) to each add the polygon ABCE, and the polygon ABCDE shall be equivalent to the polygon ABCG.

In like manner, if the diagonal CA be drawn into BF parallel to CA, meeting EA produced, and CF be joined, the triangle CFA is equivalent to the triangle CBA, and thus the polygon ABCDE is transformed to the triangle CFG.

In this way a triangle may be found equivalent to any other polygon, for by transforming the figure into another equivalent figure that has one side fewer, and repeating the operation, a figure will at last be found which has only three sides.

Scholium.

As a square may be found equivalent to a triangle, by combining this problem with Prob. XVII. a square may be found equivalent to any rectilineal figure whatever.

Problem XX.

Plate CCXLI. Fig. 8.

Upon a given line FC to construct a polygon similar to a given polygon ABCDE.

Draw the diagonals AC, AD; at the point F, make the angle GFH=BAC, and at the point G, make the angle FGH=ABC; thus a triangle FGH will be constructed similar to ABC. Again, on FH construct in like manner a triangle FIH, similar to ADC and similarly situated; and on FI construct a triangle FKI similar to AED and similarly situated; and these triangles FGH, FHI, FIK, shall form a polygon FGHIK similar to ABCDE (26. 4.).

Problem XXI.

Plate CCXLII. Fig. 11.

To inscribe a square in a given circle.

Draw two diameters AC, BD, so as to intersect each other at right angles; join the extremities of the diameters A, B, C, D, and the figure ABCD shall be a square inscribed in the circle.

For the angles AOB, BOC, &c. being all equal, the chords AB, BC, CD, DA are equal; and as each of the angles of the figure ABCD is in a semicircle, it is a right angle, (17. 2.) therefore the figure is a square.

Problem XXII.

Fig. 116.

To inscribe a regular hexagon and also an equilateral triangle in a given circle.

From any point A in the circumference, apply AB and BC each equal to AO the radius; draw the three diameters AD, BE, CF, and join their adjacent extremities by the lines AB, BC, &c. and the figure ABCDEF thus formed is the hexagon required.

For the triangles AOB, BOC being by construction equilateral, each of the angles AOB, BOC is one-third of two right angles, (4. cor. 24. 1.) and since AOB+BOC+COD=two right angles, therefore COD=one third of two right angles, therefore the three angles AOB, BOC, COD, are equal, and as these are equal to the angles AOF, FOE, EOD, the six angles at the centre are all equal; therefore, the chords AB, BC, CD, DE, EF, FA are all equal; thus the figure is equilateral. It is also equiangular, for the angles FAB, ABC, &c. are in equal segments, each having for its base the chord of two-sixths of the circumference, therefore, the angles, A, B, &c. are equal (15. 2.).

If straight lines be drawn joining A, C, E, the vertices of the alternate angles of the hexagon, there will be formed an equilateral triangle inscribed in a circle; as is sufficiently evident.

Scholium.

As the form of reasoning by which it has been shewn that an equilateral hexagon inscribed in a circle is also equiangular, will apply alike to any equilateral polygon: it may be inferred that every equilateral polygon inscribed in a circle is also equiangular.

Problem XXIII.

To inscribe a regular pentagon in a given circle. Fig. 117.

Draw any radius AO, and divide it into two parts AF, FO, such, that AO : OF :: OF : AF; (16.) from A place AG in the circumference equal to OF; join OG, and draw the chord AHB perpendicular to OG, the chord AB shall be a side of the pentagon required.

Join GF, and because AO : OF :: OF : AF, and that AG=OF, therefore, AO : AG :: AG : AF; now the angle A is common to the two triangles OAG, GAF, and it has been shewn that the sides about the angle in the two triangles are proportionals; therefore (22. 4.) the triangles are similar, and the triangle AOG being isosceles, the triangle AGF is also isosceles, so that AG=GF; but AG=FO, (by construction) therefore, GF=FO, and the angle FOG=FGO, and FOG + FGO = 2FOG; but AFG = FOG + FGO, (23. 1.) and AFG = FAG, therefore FAG = 2 FOG; hence in the isosceles triangle AOG, each of the angles at the base is double the vertical angle AOG, therefore the sum of all the angles is equal to five times the vertical angle AOG; but the sum of all the angles is equal to two right angles, (24. 1.) therefore the angle AOG is one fifth of two right angles, and consequently AOB=2AOG=two-fifths of two right angles equal one-fifth of four right angles, therefore the arch AB is one-fifth of the whole circumference. If we now suppose straight lines BC, CD, DE, to be applied in the circle each equal to AB, the chord of one-fifth of the circumference, and AE to be joined, the figure thus formed will be an equilateral pentagon, and it is also equiangular (Schol. 22.).

Problem

Of the Quadrature of the Circle.

PROBLEM XXIV.

Having given ABCD, &c. a regular polygon inscribed in a circle, to describe a regular polygon of the same number of sides about the circle.

DRAW GH a tangent to the circle at T the middle of the arch AB; do the same at the middle of each of the other arches BC, CD, &c. these tangents shall form a regular polygon GHIK, &c. described about the circle.

Join OG, OH, &c. also OT and ON. In the triangles OTH, ONH, the side OT=ON, and OH is common to both, and OTH, ONH, are right angles, therefore the triangles are equal (17. 1.) and the angles TOH=NOH; now B is the middle of the arch TN, therefore OH passes through B; and in the same manner it appears that I is in the line OC produced, &c. Now because OT bisects the arch AB it is perpendicular to the chord AB (6. 2.), therefore GH is parallel to AB (9. 2. and 18. 1.), and HI to BC, therefore the angle GHO=ABO, and IHO=CBO, and hence GHI=ABC; and in like manner it appears, that HIK=BCD, &c, therefore the angles of the circumscribed polygon are equal to those of the inscribed polygon. And because of the parallels, GH : AB :: OH : OB, and HI : BC :: OH : OB, therefore, GH : AB :: HI : BC; but AB=BC; therefore GH=HI. For the same reason HI=IK, &c. therefore, the polygon is regular, and similar to the inscribed polygon.

SECT. VI. OF THE QUADRATURE OF THE CIRCLE.

AXIOM.

Fig. 120. IF ABC be an arch of a circle, and AD, CD be two tangents at its extremities, intersecting each other in D; the sum of the tangents AD, DC is greater than the arch ABC.

Fig. 118. COR. Hence the perimeter of any polygon described about a circle, is greater than the circumference of the circle.

PROPOSITION I. THEOREM.

Fig. 119. Equilateral polygons, ABCDEF, GHIKLM, of the same number of sides inscribed in circles are similar, and are to one another as the squares of the radii of the circles.

As each of the polygons is by hypothesis equilateral, it will also be equiangular (Schol. 22. 5.). Let us suppose, for example, that the polygons are hexagons; then, as the sum of the angles is the same in both, viz. eight right angles (25. 1.), the angle A will be one-sixth part of eight right angles, and the angle G will be the same; therefore A=G; in like manner B=H, C=K, &c. and as the figures are equilateral, AB : GH :: BC : HI :: CD : IK, &c. therefore (2. def. 4.) the figures are similar. Draw AO, BO, GP, HP to the centres of the circles; then, because the angle AOB is the same part of four right angles that the arch AB is of the whole circumference; and the angle GHP the same part of four right angles that GH is of the whole circumference (13. 2.) the angles AOB, GPH are each the same part of four right angles; therefore they are equal; the isosceles triangles AOB, GPH are therefore similar, (22. 4.) and consequently AB : GH :: AO : GP, therefore (9. and 27. 4.) polygon ABCDEF : polygon GHIKLM :: $AO^2 : GP^2$.

PROP. II. THEOREM.

Fig. 121. A circle being given, two similar polygons may be found, the one inscribed in the circle, and the other described about it, which shall differ from each other by a space less than any given space.

LET AG be the side of a square equal to the given space; and let ABG be such an arch of the given circle, that AG is its chord. Bisect the fourth part of the circumference, (5. 5.) then bisect one of its halves, and proceed in this manner, till, by repeated bisections, there will at length be found an arch AB less than AG. As the arch thus found will be contained in the circumference a certain number of times exactly, its chord AB is the side of a regular figure inscribed in the circle; apply lines in the circle, each equal to AB, thus forming the regular figure ABC, &c. and describe a regular figure DEF, &c. of the same number of sides about the circle. Then, the excess of the circumscribed figure above the inscribed figure shall be less than the square upon AG. For draw lines from D and E to O the centre; these lines will pass through A and B (24. 5.); also, a line drawn from O, to H the point of contact of the line DE, will bisect AB, and be perpendicular to it; and AB will be parallel to DE. Draw the diameter AL, and join BL, which will be parallel to HO (18. 4.). Put P for the circumscribed polygon, and p for the inscribed polygon; then, because the triangles ODH, OAK are evidently like parts of P and p, P : p :: ODH : OAK (1. 3.); but the triangles ODH, OAK being similar, ODH : OAK :: $OH^2 : OK^2$ (25. 4.), and on account of the similar triangles OAK, LAB, OA^2 or OH^2 : $OK^2 :: LA^2 : LB^2$ (20. and 9. 4.); therefore, $P : p :: LA^2 : LB^2$, and by division and inversion, $P : P-p :: LA^2 : LA^2-LB^2$, or AB^2; but LA^2, that is, the square described about the circle, is greater than the equilateral polygon of eight sides described about the circle, because it contains that polygon, and for the same reason the polygon of eight sides is greater than the polygon of sixteen sides, and so on; therefore $LA^2 > P$, and as it has been proved that $P : P-p :: LA^2 : AB^2$, of which proportion, the first term P is less than the third LA^2; therefore (2. 3.) the second $P-p$ is less than the fourth AB^2, but $AB^2 < AG^2$, therefore $P-p < AG^2$.

COR. 1. Because the polygons P and p differ from one another more than either of them differs from the circle, the difference between each of them, and the circle, is less than the given space, viz. the square of AG. And therefore, however small any space may be, be, a polygon may be inscribed in the circle, and another described about it, each of which shall differ from the circle by less than the given space.

Cor. 2. A space which is greater than any polygon that can be inscribed in a circle, but which is less than any polygon that can be described about it, is equal to the circle itself.

Prop. III. Theorem.

Fig. 1.. The area of any circle is equal to a rectangle contained by the radius, and a straight line equal to half the circumference.

Let ABC, &c. be any equilateral polygon inscribed in the circle, and DEF, &c. a similar polygon described about it; draw lines from the extremities of AB and DE a side of each polygon to O the centre; and let OKH be perpendicular to these sides. Put P for the perimeter of the polygon DEF, &c. and p for the perimeter of the polygon ABC, &c. and n for the number of the sides of each. Then, because $n \times \frac{1}{2}\text{DE} = \frac{1}{2}\text{P}$, $n \times \frac{1}{2}\text{DE} \times \text{OH} = \frac{1}{2}\text{P} \times \text{OH}$, but $n \times \frac{1}{2}\text{DE} \times \text{OH} = n \times$ triangle DOE $=$ polygon DEF, &c. therefore, $\frac{1}{2}\text{P} \times \text{OH} =$ polygon DEF, &c.; and in like manner it appears, that $\frac{1}{2}p \times \text{OK} =$ polygon ABC, &c. Now let Q denote the circumference of the circle, then, because $\frac{1}{2}\text{Q} > \frac{1}{2}p$, and $\text{OH} > \text{OK}$, therefore $\frac{1}{2}\text{Q} \times \text{OH} > \frac{1}{2}p \times \text{OK}$, that is $\frac{1}{2}\text{Q} \times \text{OH}$ is greater than the inscribed polygon. Again, because $\frac{1}{2}\text{Q} < \frac{1}{2}\text{P}$ (axiom), therefore $\frac{1}{2}\text{Q} \times \text{OH} < \frac{1}{2}\text{P} \times \text{OH}$, that is, $\frac{1}{2}\text{Q} \times \text{OH}$ is less than the circumscribed polygon: Thus it appears that $\frac{1}{2}\text{Q} \times \text{OH}$ is greater than any polygon inscribed in the circle, but less than any polygon described about it; therefore, $\frac{1}{2}\text{Q} \times \text{OH}$ is equal to the circle (2.).

Prop. IV. Theorem.

Fig. 11.. The areas of circles are to one another as the squares of their radii.

Let ABCDEF and GHIKLM be equilateral polygons of the same number of sides inscribed in the circles, and OA, PG their radii; and let Q be such a space, that $\text{AO}^2 : \text{GP}^2 ::$ circle ABD : Q; then, because $\text{AO}^2 : \text{GP}^2 ::$ polygon ABCDEF : polygon GHIKLM, and $\text{AO}^2 : \text{GP}^2 ::$ circle ABE : Q, therefore polygon ABCDEF : polygon GHIKLM :: circle ABE : Q; but circle ABE $>$ polygon ABCDEF, therefore Q $>$ polygon GHIKLM; that is, Q is greater than any polygon inscribed in the circle GHL. In the same manner, it is demonstrated that Q is less than any polygon described about the circle GHL; therefore Q is equal to the circle GHL (2.). And because $\text{AO}^2 : \text{GP}^2 ::$ circle ABD : Q, therefore $\text{AO}^2 : \text{GP}^2 ::$ circle ABE : circle GHL.

Cor. 1. The circumferences of circles are to one another as their radii. Put M for half the circumference of the circle ABE, and N for half the circumference of GKL; then, circle ABE : circle GHL :: $\text{AO}^2 : \text{GP}^2$; but $\frac{1}{2}\text{M} \times \text{AO} =$ circle ABE, also $\frac{1}{2}\text{N} \times \text{GP} =$ circle GHL, (3.) therefore $\frac{1}{2}\text{M} \times \text{AO} : \frac{1}{2}\text{N} \times \text{GP} :: \text{AO}^2 : \text{GP}^2$, and by alternation $\frac{1}{2}\text{M} \times \text{AO} : \text{AO}^2 :: \frac{1}{2}\text{N} \times \text{GP} : \text{GP}^2$, therefore (3. 4.) $\frac{1}{2}\text{M} : \text{AO} :: \frac{1}{2}\text{N} : \text{GP}$, and again by alternation $\frac{1}{2}\text{M} : \frac{1}{2}\text{N} :: \text{AO} : \text{GP}$, therefore M : N :: AO : GP.

Cor. 2. A circle described with the hypothenuse of a right-angled triangle as a radius, is equal to two circles described with the other two sides as radii. Let the sides of the triangle be a, b and the hypothenuse h, and let the circles described with these lines as radii be A, B and H.

$$\begin{aligned} &\text{because A} : \text{H} :: a^2 : h^2 \\ &\text{and B} : \text{H} :: b^2 : h^2, \\ &\text{therefore A} + \text{B} : \text{H} :: a^2 + b^2 : h^2 \ (8.\ 3.) \\ &\text{but } a^2 + b^2 = h^2 \ (13.\ 4.), \text{ therefore A} + \text{B} = \text{H}. \end{aligned}$$

Prop. V. Problem.

Having given the area of a regular polygon inscribed in a circle, and also the area of a similar polygon described about it; to find the areas of regular inscribed and circumscribed polygons, each of double the number of sides. Fig. 122.

Let AB be the side of the given inscribed polygon, and EF parallel to AB that of the similar circumscribed polygon, and C the centre of the circle; if the chord AM, and the tangents AP, BQ be drawn, the chord AM shall be the side of the inscribed polygon of double the number of sides; and PQ or 2 PM that of the similar circumscribed polygon. Put A for the area of the polygon, of which AB is a side, and B for the area of the circumscribed polygon; also a for the area of the polygon of which AM is a side, and b for the area of the similar circumscribed polygon; then A and B are by hypothesis known, and it is required to find a and b.

I. The triangles ACD, ACM, which have a common vertex A, are to one another as their bases CD, CM; besides, these triangles are to one another as the polygons, of which they form like parts, therefore A : a :: CD : CM. The triangles, CAM, CME, which have a common vertex M, are to each other as their bases CA, CE; they are also to one another as the polygons a and B, of which they are like parts; therefore, a : B :: CA : CE; but because of the parallels DA, ME, CD : CM :: CA : CE; therefore, A : a :: a : B; therefore, the polygon a, which is one of the two required, is a mean proportional between the two known polygons A and B, so that $a = \sqrt{\text{A} \times \text{B}}$.

II. The triangles CPM, CPE, having the same altitude CM, are to one another as PM to PE. But as CP bisects the angle MCE, PM : PE :: CM : CE (19. 4.) :: CD : CA :: A : a; therefore, CPM : CPE :: A : a; and consequently CPM+CPE, or CME : CPM :: A+a : A, and CME : 2 CPM :: A+a : 2 A; but CME and 2 CPM, or CMPA, are to one another as the polygons B and b, of which they are like parts; therefore, A+a : 2 A :: B : b. Now the polygon a has been already found, therefore by this last proportion the polygon b is determined; that is, $b = \dfrac{2\text{A} \times \text{B}}{\text{A} + a}$.

Prop. VI. Problem.

To find nearly the ratio of the circumference of a circle to its diameter.

Let the radius of the circle $=1$, then, the sides of the inscribed square being the hypothenuse of a right-angled triangle of which the radii are the sides, (see fig.

fig. 115.) the area of the inscribed square will be 2; (13. 4.) and the circumscribed square, being the square of the diameter, will be 4. Now, retaining the notation of last problem, if we make $A=2$ and $B=4$, the formulæ $a=\sqrt{A\times B}, b=\frac{2A\times B}{A+a}$ gives us $a=2.8284271$, &c. the area of the inscribed octagon, and $b=3.3137085$, &c. the area of the circumscribed octagon. By substituting these numbers in the formulæ, instead of A and B, we shall obtain the areas of the inscribed and circumscribing polygons of 16 sides; and thence we may find those of 32 sides, and so on as in the following table:

N° *of sides.*	*Ins. Polygons.*	*Cir. Polygons.*
4	2.0000000	4.0000000
8	2.8284271	3.3137085
16	3.0614674	3.1825979
32	3.1214451	3.1517249
64	3.1365485	3.1441184
128	3.1403311	3.1432236
256	3.1412772	3.1417504
512	3.1415138	3.1416321
1024	3.1415729	3.1416025
2048	3.1415877	3.1415951
4096	3.1415914	3.1415933
8192	3.1415923	3.1415928
16384	3.1415925	3.1415927
32768	3.1415926	3.1415926

Hence it appears that the areas of a regular polygon of 32768 sides inscribed in the circle, and of a similar polygon described about it, differ so little from each other, that the numbers which express them are the same as far as the eighth decimal place. And as the circle is greater than the one polygon, and less than the other, its area will be nearly 3.1415926. But the area is the product of the radius and the half of the circumference; therefore, the radius being unity, half the circumference is 3.1415926 nearly; and the radius is to half the circumference, or the diameter is to the circumference, nearly as 1 to 3.1415926.

Scholium.

In this way the ratio of the diameter to the circumference may be found to any degree of accuracy; but neither by this, nor any other method yet known, can the ratio be exactly determined.

Archimedes, by means of inscribed and circumscribed polygons of 96 sides, found that the diameter is to the circumference as 7 to 22, nearly, which ratio is nearer to the truth than can be expressed by any smaller numbers; and Metius found it to be more nearly as 113 to 355. Both of these expressions are convenient on account of the smallness of the numbers, but later mathematicians have carried the approximation to a much greater degree of accuracy. Thus, it has been found that the diameter being 1, the circumference is greater than 3.1415926535897932, but less than the same number having its last figure increased by unity; and some have even had the patience to carry the approximation as far as the 150th place of decimals.

SECT. VII.

Definitions.

I. A straight line is *perpendicular*, or at right angles, to a plane, when it is perpendicular to every straight line meeting it in that plane. The plane is also perpendicular to the line.

II. A line is *parallel* to a plane, when they cannot meet each other, although both be produced. The plane is also parallel to the line.

III. Parallel planes are such as cannot meet each other, though produced.

IV. It will be demonstrated (Theor. 3.) that the common section of two planes is a straight line; this being premised, the *inclination* of two planes is the angle contained by two straight lines drawn perpendicular to the line, which is their common section, from any point in it, the one perpendicular being drawn in the one plane, and the other in the other plane.

This angle may be either acute or obtuse.

V. If it be a right angle the two planes are perpendicular to each other.

VI. A *solid angle* is that which is made by the meeting of more than two plane angles, which are not in the same plane, in one point. Thus the solid angle S is formed by the plane angles ASB, BSC, CSD, DSA.

Theorem I.

One part of a straight line cannot be in a plane and another part above it.

For from the definition of a plane (7. def. 1.) it is manifest that if a straight line coincide with a plane in two points it must be wholly in the plane.

Theorem II.

Two straight lines which cut each other in a plane determine its position; that is, the plane can coincide with these lines only in one position. Plat CCXI. fig. 1

Let the straight lines AB, AC cut each other in A; conceive a plane to pass through AB, and to be turned about that line, till it pass through the point C; and this it can manifestly do only in one position; then, as the points A and C are in the plane, the whole line AC must be in the plane; therefore there is only one position in which the plane can coincide with the same two lines AB, AC.

Cor. Therefore a triangle ABC, or three points A, B, C not in a straight line, determine the position of a plane.

Theorem III.

If two planes AB, CD intersect each other, their intersection is a straight line. Fig. 1

Let E and F be two points in the line of common section, and let a straight line EF be drawn between them; then the line EF must be in the plane AB, (7.

(7. def. 1.) and the same line must also be in the same plane CD, therefore it must be the common section of them both.

Theorem IV.

Fig. If a straight line AP is perpendicular to two straight lines PB, PC at P the point of their intersection; it will also be perpendicular to the plane MN, in which these lines are.

Draw any other line PQ in the plane MN, and from Q any point in that line draw QD parallel to PB; make DC=DP; join CQ, meeting PB in B; and join AB, AQ, AC. Because DQ is parallel to PB, and PD=DC; therefore BQ=QC, and BC is bisected in Q: Hence in the triangle BAC,

$$AB^2+AC^2=2\,AQ^2+2\,BQ^2, \ (16.\ 4.)$$

and in the like manner, in the triangle PBC,

$$PB^2+PC^2=2\,PQ^2+2\,CQ^2;$$

therefore, taking equal quantities from equal quantities, that is, subtracting the two last quantities, which are put equal to each other, from the two first, and observing that as APB, APC are by hypothesis right-angled triangles, $AB^2-BP^2=AP^2$, and $AC^2-CP^2=AP^2$, we have

$$AP^2+AP^2=2\,AQ^2-2\,PQ^2,$$

and therefore $AP^2=AQ^2-PQ^2$, or $AP^2+PQ^2=AQ^2$; therefore the triangle APQ is right-angled at P, (schol. 15. 4.) and consequently AP is perpendicular to the plane MN (Def. 1.).

Cor. 1. The perpendicular AP is shorter than any oblique line AQ, therefore t measures the distance of the point A from the plane.

Cor. 2. From the same point P in a plane no more than one perpendicular can be drawn. For if it be possible that there can be two perpendiculars, conceive a plane to pass through them, and to intersect the plane MN in the straight line PQ; then these perpendiculars will be in the same plane, and both perpendicular to the same line PQ, at the same point P in that line, which is impossible.

It is also impossible that from a point without a plane two perpendiculars can be drawn to the plane; for if the straight lines AP, AQ could be two such perpendiculars, then the triangle APQ would have two right angles, which is impossible.

Theorem V.

Fig. 126. If a straight line AP be perpendicular to a plane MN, every straight line DE parallel to AP is perpendicular to the same plane.

Let a plane pass through the parallel lines AP, DE, and intersect the plane MN in the line PD; through D draw BC at right angles to PD; take DC=DB, and join PB, PC, AB, AC, AD. Because DB=DC, therefore PB=PC; (cor. 4. 1.) and because AP is perpendicular to the plane MN, so that APB, APC are right angles, AB=AC, (cor. 5. 1.) therefore ABC is an isosceles triangle; and since its base BC is bisected at D, BC is perpendicular to AD; (schol. 11. 1.) but by construction BC is perpendicular to PD; therefore (4.) BC or BD is perpendicular to the plane passing through the lines AD and PD, or AP and DE; hence BD is perpendicular to DE, but PD is also perpendicular to DE, (19. 1.) therefore DE is perpendicular to the two lines DP, DB; and therefore it is perpendicular to the plane MN passing through them.

Cor. 1. Conversely, if the straight lines AP, DE are perpendicular to the same plane MN, they are parallel; for if not, through D draw a parallel to AP; this parallel will be perpendicular to the plane MN, (by the theorem) therefore, from the same point D two perpendiculars may be drawn to a plane, which is impossible (4.).

Cor. 2. Two straight lines A and B which are parallel to a third line C, though not in the same plane, are parallel to each other. For suppose a plane to be perpendicular to the line C, the lines A and B parallel to this perpendicular are perpendicular to the same plane; therefore, by the preceding corollary, they are parallel between themselves.

Theorem VI.

Two planes MN, PQ, perpendicular to the same straight line AB, are parallel to each other. Fig. 127.

For, if they can meet each other, let O be a point common to both, and join OA, OB; then the line AB, which is perpendicular to the plane MN, must be perpendicular to AO, a line drawn in the plane MN from the point in which AB meets that plane. For the same reason AB is perpendicular to BO; therefore OA, OB are two perpendiculars drawn from the same point O, to the same straight line AB, which is impossible.

Theorem VII.

The intersections EF, GH of two parallel planes MN, PQ with a third plane FG, are parallel. Fig. 128.

For if the lines EF, GH, situated in the same plane, are not parallel, they must meet if produced; therefore, the planes MN, PQ, in which they are, must also meet, which is contrary to the hypothesis of their being parallel.

Theorem VIII.

Any straight line AB, perpendicular to MN, one of two parallel planes MN, PQ, is also perpendicular to PQ the other plane. Fig. 127.

From B draw any straight line BC in the plane PQ, and let a plane pass through the lines AB, BC, and meet the plane MN in the line AD, then AD will be parallel to BC, (7.), and since AB is perpendicular to the plane MN, it must be perpendicular to the line AD, therefore it is also perpendicular to BC; (19. 1.) hence (Def. 1.) the line AB is perpendicular to the plane PQ.

Theorem IX.

Parallel straight lines EG, FH, comprehended between two parallel planes MN, PQ, are equal. Fig. 128.

Let a plane pass through the lines EG, FH, and meet

meet the parallel planes in EF and GH; then EF and GH are parallel (7.) as well as EG and FH; therefore, EGHF is a parallelogram, and EF=GH.

Cor. Hence two parallel planes are everywhere at the same distance from each other. For, if EF and GH are perpendicular to the two planes, they are parallel, (1. cor. 5.) therefore they are equal.

Theorem X.

Fig. 129. If two straight lines CA, EA, meeting one another, be parallel to two other lines DB, FB, that meet one another, though not in the same plane with the first two; the first two and the other two shall contain equal angles, and the plane passing through the first two shall be parallel to the plane passing through the other two.

Take AC=BD, AE=BF, and join CE, DF, AB, CD, EF. Because AC is equal and parallel to BD, the figure ABDC is a parallelogram; therefore, CD is equal and parallel to AB. For a similar reason EF is equal and parallel to AB; therefore also CE is equal and parallel to DF (2 cor. 5. and 28. 1.); therefore the triangles CAE, DBF are equal, (10. 1.) hence the angle CAE=DBF.

In the second place, the plane ACE is parallel to the plane BDF: For suppose that the plane parallel to BDF, passing through the point A, meets the lines CD, EF in any other points than C and E, (for example in G and H), then (9.) the three lines AB, GD, FH are equal; but the three lines AB, CD, EF have been shewn to be equal; therefore, CD=GD, and FH=EF, which is absurd, therefore the plane ACE is parallel to BDF.

Theorem XI.

Fig. 130. If a straight line AP be perpendicular to a plane MN, any plane APB, passing through AP, shall be perpendicular to the plane MN.

Let BC be the intersection of the planes AB, MN; if in the plane MN the line DE be drawn perpendicular to BP, the line AP, being perpendicular to the plane MN, shall be perpendicular to each of the straight lines BC, DE; therefore the angle APD is a right angle; now PA and PD are drawn in the planes AB, MN perpendicular to their common section, therefore (5. Def.) the planes AB, MN are perpendicular to each other.

Scholium.

When three straight lines, such as AP, BP, DP, are perpendicular to each other, each is perpendicular to the plane of the two other lines.

Theorem XII.

Fig. 130. If the plane AB is perpendicular to the plane MN; and in the plane AB a straight line PA be drawn perpendicular to BP, the common intersection of the planes, then shall PA be perpendicular to the plane MN.

For, if in the plane MN, a line PD be drawn perpendicular to PB, the angle APD shall be a right angle, because the planes are perpendicular to each other, therefore, the line AP is perpendicular to the two lines PB, PD, therefore it is perpendicular to their plane MN.

Cor. If the plane AB be perpendicular to the plane MN, and from any point P, in their common intersection, a perpendicular be drawn to the plane MN; this perpendicular shall be in the plane AB; for if it is not, a perpendicular AP may be drawn in the plane AB to the common intersection BP, which will be at the same time perpendicular to the plane MN; therefore, at the same point P, there may be two perpendiculars to a plane NM, which is impossible (4.).

Theorem XIII.

If two planes AB, AD are perpendicular to a third, their common intersection AP is perpendicular to the third plane. Fig.

For, if through the point P, a perpendicular be drawn to the plane MN, this perpendicular shall be in the plane AB, and also in the plane AD, (cor. 12.) therefore it is at their common intersection AP.

Theorem XIV.

If two straight lines be cut by parallel planes, they shall be cut in the same ratio. Fig.

Let the line AB meet the planes MN, PQ, RS in A, E, B; and let CD meet them in C, F, D, then shall AE : EB :: CF : FD. For draw AD meeting the plane PQ in G, and join AC, EG, GF, BD; the lines EG, BD, being the common sections of the plane of the triangle ABD and the parallel planes PQ, RS, are parallel (7.), and in like manner it appears, that AC, GF are parallel; therefore AE : EB (:: AG : GD) :: CF : FD.

Theorem XV.

If a solid angle be contained by three plane angles, the sum of any two of these is greater than the third. Fig.

It is evidently only necessary to demonstrate the theorem, when the plane angle which is compared with the sum of the other two is greater than either of them; for, if it were equal to or less than one of them, the theorem would be manifest: therefore let S be a solid angle formed by three plane angles ASB, ASC, BSC, of which ASB is the greatest. In the plane ASB make the angle BSD=BSC; draw any straight line ADB, and having taken SC=SD, join AC, BC; the triangles BSC, BSD having two sides, and the included angle of the one equal to two sides, and the included angle of the other, each to each, are equal (5. 1.), therefore BE=BC; now AB $\angle$ AC+BC, therefore, taking BD from the first of these unequal quantities, and BC from the second, we get AD $\angle$ AC; and as the triangles ASD, ASC have SD=SC, and SA common to both, and AD $\angle$ AC, therefore (9. 1.) the angle ASD $\angle$ ASC; and, adding DSB to the one, and CSB to the other, ASB $\angle$ ASC+BSC.

Theorem XVI.

If each of two solid angles be contained by three plane Fig.

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plane angles equal to one another, each to each, the planes in which the equal angles are, have the same inclination to one another.

Let the angle ASB=DTE, the angle ASC =DTF, and the angle BSC=ETF; the two planes ASB, ASC, shall have to each other the same inclination as the two planes DTE, DTF.

Take A any point in SA, and in the two planes ASB, ASC, draw AB and AC perpendiculars to AS, then (def. 4.) the angle BAC is the inclination of these planes; again, take TD=SA, and in the planes TDE, TDF draw DE and DF perpendiculars to TD, and the angle EDF shall be the inclination of these other planes; join BC, EF. The triangles ASB, DTE have the side AS=DT, the angle SAB=TDE and ASB=DTE, therefore the triangles are equal, and thus AB=DE, and SB=TE: In like manner it appears that the triangles ASC, DTF are equal, and therefore, that AC=DF, and SC=TF. Now the triangles BSC, ETF, having BS=TE, SC=TF, and the angle BSC=ETF, are also equal, and therefore BC=EF; but it has been shewn that AB=DE, and that AC=DF; therefore the triangles BAC, EDF are equal, and consequently the angle BAC=EDF; that is, the inclination of the planes ASB and ASC is equal to the inclination of the planes DTE and DTF. In the same manner it may be proved that the other planes have the same inclination to one another.

Scholium.

If the three plane angles which contain the solid angles, are equal each to each, and if besides the angles are also *disposed in the same order* in the two solid angles, then these angles when applied to one another will coincide, and be equal. But if the plane angles be *disposed in a contrary order*, the solid angles will not coincide, although the theorem is equally true in both cases. In this last case the solid angles are called *Symmetrical angles.*

SECT. VIII. OF SOLIDS BOUNDED BY PLANES.

Definitions.

I. A *Solid* is that which has length, breadth, and thickness.

II. A *Prism* is a solid contained by plane figures, of which two that are opposite are equal, similar, and parallel; and the others are parallelograms.

Fig. 4. To construct this solid, let ABCDE be any polygon: if in a plane parallel to ABC there be drawn straight lines FG, GH, HI, &c. equal and parallel to the sides AB, BC, CD, &c. so as to form a polygon FGHIK equal to ABCDE, and straight lines AF, BG, CH, &c. be drawn, joining the vertices of the homologous angles in the two planes; the planes or faces ABGF, BCHG, &c. thus formed will be parallelograms; and the solid ABCDEFGHIK contained by these parallelograms and the two polygons, is the prism itself.

III. The equal and parallel polygons ABCDE, FGHIK are called the *Bases* of the prism, and the distance between the bases is its *Altitude.*

Fig. 5. IV. When the base of a prism is a parallelogram, and consequently the figure has all its faces parallelograms, it is called a *parallelopiped.* A parallelopiped is *rectangular* when all its face are rectangles.

V. A *Cube* is a rectangular parallelopiped contained by six equal squares.

Pl. CCXV. Fig. 1. VI. A *Pyramid* is a solid contained by several planes, which meet in the same point A, and terminate in a polygonal plane BCD.

VII. The polygon ABCDE is called the *Base* of the pyramid; the point S is its *Vertex;* and a perpendicular let fall from the vertex upon the base is called its *Altitude.*

VIII. Two solids are *similar,* when they are contained by the same number of similar planes, similarly situated, and having like inclinations to one another.

Theorem I.

Two prisms are equal when the three planes which contain a solid angle of the one are equal to the three planes which contain a solid angle of the other, each to each, and are similarly situated. Plate CCXLIV. Fig. 134.

Let the base ABCDE be equal to the base *a b c d e*, the parallelogram ABGF equal to the parallelogram *a b g f*, and the parallelogram BCHG equal to the parallogram *b c h g;* the prism ABCI shall be equal to the prism *a b c i.*

For let the base ABCDE be applied to its equal the base *a b c d e*, so that they may coincide with each other; then, as the three plane angles which form the solid angle B are equal to the three plane angles which form the angle *b*, each to each, viz. ABC=*a b c* ABG=*a b g*, and GBC=*g b c*, and as these angles are similarly situated, the solid angles B and *b* are equal (15. 7.) therefore the side BG shall fall upon the side *b g;* and because the parallelograms ABGF, *a b g f* are equal, the side FG shall fall upon its equal *f g;* in like manner it may be shewn, that GH falls upon *g h*, therefore the upper base FGHIK coincides entirely with its equal *f g h i k*, and the two solids coincide with each other, or occupy the same space, therefore the prisms are equal.

Scholium.

A prism is entirely determined, when its base ABCDE is known, and its edge BG is given in magnitude and position; for if through the point G, GF be drawn equal and parallel to AB, and GH equal and parallel to BC, and the polygon FGHIK be described equal to ABCDE (20. 5.), it is evident that the

 points

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points FKI will have determinate positions; therefore any two prisms constructed with the same *data* cannot be unequal.

Theorem II.

Fig. 135. In any parallelopiped the opposite planes are equal and parallel.

From the nature of the solid (4. def.) the bases ABCD, EFGH are equal parallelograms, and their sides are parallel, therefore the planes AC, EG are parallel; and because AD is equal and parallel to BC, and AE is equal and parallel to BF, the angle DAE =CBF, and the plane DAE is parallel to the plane CBF, (10. 7.) therefore also the parallelogram DAEH is equal to the parallelogram CBFG. It may in like manner be demonstrated, that the opposite parallelograms ABFE, DCGH are equal and parallel.

Cor. Hence, in a parallelopiped, any one of the six planes which contain it may be taken for its base.

Theorem III.

Fig. 136. The plane BDHF, which passes through two parallel opposite edges BF, DH, of a parallelopiped AG, divides it into two triangular prisms ABDHEF, GHFBCD, equal to one another.

For the triangles ABD, EFH, having their sides equal and parallel, are equal, and the lateral faces ABFE, ADHE, BDHF are parallelograms; therefore the solid ABDHEF is a prism; for like reasons the solid GHFBCD is a prism. Again, because the plane angles which contain the solid angle at G are equal to those which contain the solid angle at A, viz. the angle FGH=DAB, FGC=DAE, and HGC =BAE, the planes in which these angles are have the same inclination to one another, (16. 7.); as, however, these angles are not disposed in the same order, but in a contrary order, the solid angles cannot be made to coincide with one another, and consequently the prisms cannot be proved equal by superposition, as in Theorem I. Their equality may however be established by reasoning thus:

The inclination of each of any two adjacent faces of a prism to the base, and the length of an edge being given, the prism is evidently restricted to one determinate magnitude; and it will evidently have the same magnitude whichsoever of the two sides of the base it may stand upon; that is, whether it be constructed above or below the base. Now if the upper base FGH of the one prism be applied to the lower base DAB of the other, so that the sides FG, GH, FH may be upon the sides DA, AB, DB equal to them, then the prism GHFBCD will have the position ABDHEF′; and the two faces ABF′E′ of ADH′E′ of the prism below the base will have each the same inclination to it, as the equivalent faces ABFE, ADHE of the prism above the base; and the edge AE′ is equal to the edge AE; therefore the conditions which determine the magnitude of both prisms are identical, and consequently the prisms are equal.

Theorem IV.

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If two parallelopipeds AG, AL have a common base ABCD, and have their upper bases in the same plane, and between the same parallel straight lines EK, HL, the two parallelopipeds are equivalent to each other. Fig. 137. Fig. 138.

Because AE is parallel to BF, and HE to GF, the angle AEI=BFK, HEI=GFK, and HEA =GFB; of these six angles the three first form the solid angle E, and the three others form the solid angle F; therefore since the plane angles are equal each to each, and similarly situated, the solid angles E and F are equal. Now if the prism AEIDHM be applied to the prism BFKCGL, so that their bases AEI, BFK, which are equal, may coincide with each other, then, because the solid angle E is equal to the solid angle F, the side EH shall fall upon FG, and this is all that is necessary to prove that the two prisms coincide entirely, for the base AEI and the edge EH determine the prism AEM, and the base BFK and the edge FG determine the prism BFL; therefore the prisms are equal. But if from the solid AEL, the prism AEM be taken away, there will remain the parallelopiped AIL; and if from the same solid AEL, the prism BFL be taken away, there will remain the parallelopiped AEG; therefore the parallelopipeds AIL, AEG are equivalent to each other.

Theorem V.

Parallelopipeds upon the same base, and having the same altitude, are equivalent to one another. Fig. 139.

Let ABCD be the common base of the two parallelopipeds AG, AL, which, because they have the same altitude, will have their upper bases in the same plane; then, because EF and AB are equal and parallel, as also IK and AB; EF is parallel to IK, (cor. 2. 5. 7.) for a similar reason GF is parallel to LK. Let the sides EF, HG, as also the sides LK, IM, be produced, so as to form by their intersections the parallelogram NOPQ; it is manifest that this parallelogram is equal to each of the bases EFGH, IKLM. Now, if we suppose a third parallelopiped, which, with the same lower base ABCD, has for its upper base NOPQ, this third parallelopiped will be equivalent to the parallelopiped AG, (4.) for the same reason the third parallelopiped will be equivalent to the parallelopipeds AL; therefore the two parallelopipeds AG, AL, which have the same base and the same altitude, are equivalent to one another.

Theorem VI.

Any parallelopiped AG is equivalent to a rectangular parallelopiped, having the same altitude, and an equivalent base. Fig. 139, 140.

At the points A, B, C, D, let AI, BK, CL, DM, be drawn perpendicular to the plane ABCD, and terminating in the plane of the upper base; then, IK, KL, KL, LM, MI, being joined, a parallelopiped AL will thus be formed, which will manifestly have its lateral faces AK, BL, CM, DI rectangles; and if the base AC is also a rectangle, the solid AL will be a rectangular parallelopiped equivalent to the parallelopiped AG. But if ABCD is not a rectangle, (fig. 140.) draw AO and BN perpendicular to CD, and OQ and NP perpendicular to DC, meeting ML in Q and P; the solid ABNOIKPQ will manifestly be a rectangular parallelopiped, which will be equal to the parallelopiped AL, for they have the same base ABKI, and the same altitude, viz. AO; therefore the rectangular parallelopiped AP is equivalent to the parallelopiped AG, (fig. 139.) and they have the same altitude, and the base ABNO of the former is equivalent to the base ABCD of the latter.

Theorem VII.

Fig. 144. Any section NOPQR of a prism, made by a plane parallel to its base ABCDE, is equal to the base.

For the parallels AN, BO, CP contained between the parallel planes ABC, NOP are equal (9. 7.); and thus all the figures ABON, BCPO, &c. are parallelograms; hence the side ON=AB, OP=BC, PQ=CD, &c. also, the equal sides are parallel, therefore, the angle ABC = NOP, the angle BCD = OPQ, &c. therefore the two polygons ABCDE, NOPQR, have their sides and angles equal, each to each; therefore, they are equal.

Theorem VIII.

Plate CCLV. fig. 1. Two rectangular parallelopipeds AG, AL, which have the same base ABCD, are to each other as their altitudes AE, AI.

Suppose that the altitudes AE, AI are to each other as the numbers p and q, so that AE will contain p such equal parts as AI contains q. Let AE and AI be divided into p and q equal parts respectively, and let planes pass through the points of division parallel to the base ABCD; thus the parallelopiped AG will be divided into p solids, which will also be parallelopipeds having equal bases (7.) and equal altitudes, therefore they will be equal among themselves; and in like manner the parallelopiped AL will be divided into q equal solids; and as each of the solids in AG is equal to each of the solids in AL, the parallelopiped AG will contain p such equal parts as the parallelopiped AL contains q; therefore the parallelopiped AG will be to the parallelopiped AL as the number p to the number q, that is, as AE the altitude of the former to AI the altitude of the latter.

Theorem IX.

Fig. 140. Two rectangular parallelopipeds AG, AK, which have the same altitude AE, are to each other as their bases ABCB, AMNO.

Let the two solids be placed, the one by the side of the other, as represented in the figure, and let the plane ONKL be produced, so as to meet the plane DCGH in PQ, thus forming a third parallelopiped AQ, which may be compared with each of the parallelopipeds AG, AK. The two solids AG, AQ, having the same base ADHE, are to each other as their altitudes AB, AO, (8.) and, in like manner, the two solids AQ, AK, having the same base AOLE, are to each other as their altitudes AD, AM; that is,

solid AG : *sol.* AQ :: AB : AO
sol. AQ : *sol.* AK :: AD : AM;

but AB : AO :: *base* AC : *base* AP (3. 4.)
and AD : AM :: *base* AP : *base* AN,

therefore,

sol. AG : *sol.* AQ :: *base* AC : *base* AP,
sol. AQ : *sol.* AK :: *base* AP : *base* AN,

therefore (7. 3.)

sol. AG. *sol.* AK :: *base* AC : *base* AN.

Theorem X.

Rectangular parallelopipeds are to each other as the products of the numbers proportional to their bases and altitudes, or as the products of the numbers proportional to their three dimensions. Fig. 142.

Let AG be a parallelopiped, the three dimensions of which are expressed by the lines AB, AD, AE, and AZ another parallelopiped the dimensions of which are expressed by the lines AO, AM, AX. Let the two solids AG, AZ be so placed that their surfaces may have a common angle BAE; produce such of the planes as are necessary so as to form a third parallelopiped AK, having the same altitude as the parallelopiped AG. By the last proposition

sol. AG : *sol.* AK :: *base* AC : *base* AN,

and by the last theorem but one,

sol. AK : *sol.* AZ :: AE : AX,

but, considering the bases AC, AN as measured by numbers, as also the altitudes AE, AX,

base AC : *base* AN :: AE × *base* AC : AE × *base* AN
and AE : AX :: AE × *base* AN : AX × *base* AN

therefore,

sol. AG : *sol.* AK :: AE × *base* AC : AE × *base* AN,
sol. AK : *sol.* AZ :: AE × *base* AN : AX × *base* AN,

therefore, (7. 3.)

sol. AG : *sol.* AZ :: AE × *base* AC : AX × *base* AN;

which proportion, by substituting for the bases AC, AN their numerical values AB × AD aud AO × AM becomes

sol. AG : *sol.* AZ :: AB × AD × AE : AO × AM × AX.

Scholium.

Hence it appears that the product of the base of a rectangular parallelopiped by its altitude or the product of its three dimensions, may be taken for its numerical measure;

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measure; and it is upon this principle that all other solids are estimated. When two parallelopipeds are compared together by means of their bases and altitudes, their bases must be considered as measured by the same superficial unit, and their altitudes by the same linear unit; thus if P and Q denote two parallelopipeds, and the base of P contains three such equal spaces as that of Q contains four; and the altitude of P contains two such equal lines, as that of Q contains five, then, $P : Q :: 3\times2 : 4\times5 :: 6 : 20$.

If all the dimensions of each solid are used in comparing them together, then the same linear unit must be employed in estimating all the dimensions of both solids; thus, if the length, breadth, and height of the solid P be four, three, and six linear units, respectively; and those of Q, seven, two, and five of the same unit; then $P : Q :: 4\times3\times6 : 7\times2\times5 :: 72 : 70$.

As lines are compared together by considering how often each contains some other line taken as a measuring unit, and surfaces by considering how often each contains a square whose side is that unit; so solids may be compared, by considering how often each contains a cube, the side or edge of which is the same linear unit. Accordingly, the dimensions of the parallelopipeds P and Q being as we have just now supposed, the proportion $P : Q :: 72 : 70$ may be considered as indicating that P contains 72 such equal cubes as Q contains 70.

The magnitude of a solid, its bulk, or its extension, constitutes its *solidity*, or its *content*; thus we say, that the solidity or the content of a rectangular parallelopiped is equal to the product of its base by its altitude; or to the product of its three dimensions.

Theorem XI.

The solidity of any parallelopiped, or in general of any prism, is equal to the product of its base by its altitude.

1. Any parallelopiped is equivalent to a rectangular parallelopiped of the same altitude, and an equivalent base (6.); and it has been shewn, that the solidity of such a parallelopiped is equal to the product of its base and altitude.

2. Every triangular prism is the half of a parallelopiped of the same altitude, but having its base double that of the prism (3.); therefore, the solidity of the prism is half that of the parallelopiped, or it is half the product of the base of the parallelopiped by its altitude, that is, it is equal to the product of the base of the prism by its altitude.

3. Any other prism may be divided into as many triangular prisms as the polygon which forms its base can be divided into triangles, but the solidity of each of these is equal to the product of its base by their common altitude; therefore, the solidity of the whole prism is equal to the product of the sum of all their bases by the common altitude, or it is equal to the product of the base of the prism, which is the sum of them all, by its altitude.

Cor. Two prisms having the same altitude are to each other as their bases; and two prisms having the same base are to each other as their altitudes.

3

Theorem XII.

Fig. 14

Similar prisms are to one another as the cubes of their homologous sides.

Let AG, IP be two similar prisms, of which AB, IK are two homologous sides, the prism AG is to the prism IP as the cube of AB to the cube of IK. Let E and N be two homologous angles of the prisms, and ES, NV perpendiculars to the planes of their bases; join IV; take IR=AE, and in the plane INV draw RT perpendicular to IV; then RT shall be perpendicular to the plane IL (11. and 12. of 7.), also RT shall be equal to ES; for if the solid angles A and I were applied the one to the other, the planes which contain them would coincide (schol. 16. 7.), and the point E would fall upon the point R, and therefore the perpendicular ES would coincide with the perpendicular RT (2. cor. 4. 7.). Now the content of a prism being the product of its base by its altitude (11.), it follows that *prism* AG : *prism* IP :: ES$\times$*base* AC :: NV$\times$ *base* IL; but *base* AC : *base* IL :: $AB^2 : IK^2$ (27. 4.) and therefore considering the lines expressed by numbers, ES $\times$ *base* AC or RT $\times$ *base* AC : NV $\times$ *base* IL :: $RT\times AB^2 : NV \times IK^2$ (5. 3.) therefore *prism* AG : *prism* IP :: $RT\times AB^2 : NV\times IK^2$; but RT : NV :: RI or AE : NI (20. 4.) :: AB : IK (def. of sim. figs.), and consequently $RT\times AB^2 : NV\times IK^2 :: AB^3 : IK^3$ (5. 3.); therefore *prism* AG : *prism* IP :: $AB^3 : IK^3$.

Cor. Similar prisms are to one another in the triplicate ratio of the homologous sides. For let Y and Z be two such lines that AB : IK :: IK : Y :: Y : Z, then the ratio of AB to Z is triplicate the ratio of AB to IK (12. def. 3.). Now, since AB : IK :: IK : Y, therefore $AB^2 : IK^2 :: IK^2 : Y^2$, (9. 4.) and, multiplying the antecedents by AB, and consequents by IK, $AB^3 : IK^3 :: AB\times IK^2 : IK\times Y^2 :: AB\times IK : Y^2$, but $Y^2=IK\times Z$ (8. 4.); therefore $AB^3 : IK^3 :: AB\times IK : IK\times Z$ :: AB : Z, but *prism* AG : *prism* IP :: $AB^3 : IK^3$, therefore *prism* AG : *prism* IP :: AB : Z, which last ratio is triplicate the ratio of AB to IK.

Theorem XIII.

Fig. 14

If a triangular pyramid ABCD be cut by a plane $b\,c\,d$ parallel to its base, the section $b\,c\,d$ is similar to the base BCD.

For because the planes $b\,c\,d$, BCD are parallel, their intersections $b\,c$, BC with a third plane BAC are parallel (7. 7.); and, for a like reason, $c\,d$ is parallel to CD, and $d\,b$ to DB; therefore the angle $b\,c\,d$=BCD, $c\,d\,b$=CDB, and $d\,b\,c$=DBC (10. 7.); hence the triangles $b\,c\,d$, BCD are equiangular, and consequently similar.

Cor. 1. If two triangular pyramids ABCD, EFGH, which have equal bases, and equal altitudes, be cut by planes $b\,c\,d, f\,g\,h$ that are parallel to the bases, and at equal distances from them, the sections are equal. For conceive the bases of the pyramids to be in the same plane, then their vertices will be in a plane parallel to their bases, and the sections, $b\,c\,d, f\,g\,h$ will also be in a plane parallel to their bases, therefore, AB : Ab ::

EF :

EF : Ef (14. 7.), but because the the triangles ABC, Abc are similar, AB : Ab :: BC : bc, and, in like manner EF : Ef :: FG : fg, therefore, BC : bc :: FG : fg, and $BC^2 : bc^2 :: FG^2 : fg^2$ (9. 4.); but $BC^2 : bc^2$ :: *triangle* BCD : *trian.* bcd, and $FG^2 : fg^2$ :: *trian.* FGH : *trian.* fgh (25. 4.); therefore, *trian.* BCD : *trian.* bcd :: *trian.* FGH : *trian.* fgh, but *trian.* BCD=*trian.* FGH (by hyp.) therefore *trian.* bcd=*trian.* fgh.

Scholium.

It is easy to see that what is here demonstrated of triangular pyramids, is equally true of polygonal pyramids having equal bases and altitudes.

Theorem XIV.

Fig. 145. A series of prisms of the same altitude may be circumscribed about any pyramid ABCD, such that the sum of the prisms shall exceed the pyramid by a solid less than any given solid Z.

Let Z be equal to a prism standing on the same base with the pyramid, viz. the triangle BCD, and having for its altitude the perpendicular drawn from a certain point E in the line AC upon the place BCD. It is evident that CE multiplied by a certain number m will be greater than AC; divide CA into as many equal parts as there are units in m, and let these be CF, FG, GH, HA, each of which will be less than CE. Through each of the points F, G, H, let planes be made to pass parallel to the plane BCD, making with the sides of the pyramid the sections FPQ, GRS, HTU, which will be all similar to one another, and to the base BCD (13.). From the point B draw in the plane of the triangle ABC the straight line BK parallel to CF, meeting FP produced in K. In like manner, from D draw DL parallel to CF, meeting FQ in L; join KL, and it is plain that the solid KBCDLF is a prism. By the same construction let the prisms PM, RO, TV be described. Also let the straight line IP, which is in the plane of the triangle ABC be produced till it meet BC in h; and let the line MQ be produced till it meet DC in g. Join hg, then hCg QFP is a prism; and is equal to the prism PM (cor. 11.). In the same manner is described the prism mS equal to the prism RO, and the prism qU equal to the prism TV. The sum, therefore, of all the inscribed prisms hQ, mS and qU is equal to the sum of the prisms PM, RO and TV, that is, to the sum of all the circumscribed prisms except the prism BL; wherefore, BL is the excess of the prisms circumscribed about the pyramid above the prisms inscribed within it. But the prism BL is less than the prism which has the triangle BCD for its base, and for its altitude the perpendicular from E upon the plane BCD, which prism is, by hypothesis, equal to the given solid Z; therefore the excess of the circumscribed above the inscribed prisms is less than the solid Z. But the excess of the circumscribed prisms above the inscribed is greater than their excess above the pyramid ABCD, because ABCD is greater than the sum of the inscribed prisms; much more therefore is the excess of the circumscribed prisms above the pyramid less than the solid Z. A series of prisms of the same altitude has therefore been circumscribed about the pyramid ABCD exceeding it by a solid less than the given solid Z.

Theorem XV.

Pyramids that have equal bases and altitudes are equal to one another. Fig. 146.

Let ABCD, EFGH be two pyramids that have equal bases BCD, FGH, and also equal altitudes; the pyramid ABCD is equal to the pyramid EFGH.

If they are unequal, let the pyramid EFGH exceed the pyramid ABCD by the solid Z. Let a series of prisms of the same altitude be circumscribed about the pyramid ABCD that shall exceed it by a solid less than Z, (14.) and let another series equal in number to the former, and having all the same altitude, be described about the pyramid EFGH; then, because the pyramids have equal altitudes, the altitude of each of the prisms described about the one pyramid is equal to the altitude of each of the prisms described about the other pyramid; therefore the sections of the pyramids which are the bases of the corresponding prisms will be at equal distances from the bases of the pyramids, and hence these sections will be equal; (1. cor. 13.) and because the prisms have all the same altitude, the corresponding prisms will be equal, and the sum of the prisms described about the pyramid ABCD will be equal to the sum of the prisms described about the pyramid EFGH. Let the pyramid EFGH be denoted by P, and the pyramid ABCD by p, and put Q for the sum of the prisms described about P, and q for the prisms described about p: Then by hypothesis $Z=P-p$, and by construction $Z>q-p$, therefore $P-p>q-p$, and consequently $P>q$; but it has been shewn that $q=Q$, therefore $P>Q$, that is, the pyramid EFGH is greater than the sum of the prism described about it, which is impossible, therefore the pyramids ABCD, EFGH are not unequal, that is, they are equal.

Theorem XVI.

Every prism having a triangular base may be divided into three pyramids that have triangular bases, and that are equal to one another. Fig. 147.

Let ABC, DEF be the opposite bases of a triangular prism. Join AE, EC, CD; and because ABED is a parallelogram, of which AE is the diameter, the triangle ADE is equal to the triangle ABE; therefore the pyramid of which the base is the triangle ADE and vertex the point C, is equal to the pyramid of which the base is the triangle ABE, and vertex the point C. But the pyramid of which the base is the triangle ABE and vertex the point C, that is the pyramid ABCE, is equal to the pyramid DEFC, (15.) for they have equal bases, viz. the triangles ABC, DFE, and the same altitude, viz. the altitude of the prism ABCDEF. Therefore, the three pyramids ADEC, ABEC, DFEC are equal to one another; but these pyramids make up the whole prism ABCDEF; therefore, the prism ABCDEF is divided into three equal pyramids.

Cor. 1. From this it is manifest that every pyramid

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mid is the third part of a prism which has the same base and the same altitude with it; for if the base of the prism be any other figure than a triangle, it may be divided into prisms having triangular bases.

Cor. 2. Pyramids having equal altitudes are to one another as their bases; because the prisms upon the same bases, and of the same altitude, are to one another as their bases.

Of Cylinders, Cones, and the Sphere.

SECT. IX. OF CYLINDERS, CONES, AND THE SPHERE.

Definitions.

I. A *Cylinder* is a solid figure described by the revolution of a right-angled parallelogram about one of its sides, which remains fixed.

The *Axis* of the cylinder is the fixed straight line about which the parallelogram revolves.

The *Bases* of the cylinder are the circles described by the two revolving opposite sides of the parallelogram.

II. A *Cone* is a solid figure described by the revolution of a right-angled triangle about one of the sides containing the right angle, which side remains fixed.

The *Axis* of the cone is the fixed line about which the triangle revolves.

The *Base* of the cone is the circle described by that side containing the right angle which revolves.

III. A *Sphere* is a solid figure described by the revolution of a semicircle about a diameter.

The *Axis* of a sphere is the fixed line about which the semicircle revolves.

The *Centre* of a sphere is the same with that of the semicircle.

The *Diameter* of a sphere is any straight line which passes through the centre, and is terminated both ways by the superficies of the sphere.

IV. *Similar* cones and cylinders are those which have their axes and diameters of their bases proportional.

Theorem I.

Fig. 148. If from any point E in the circumference of the base of a cylinder ABCD, a perpendicular EF be drawn to the plane of the base AEB, the straight line EF is wholly in the cylindric superficies.

Let HG be the axis, and AGHD the rectangle, which by its revolution describes the cylinder. Because HG is perpendicular to AG in every position of the revolving rectangle, it is perpendicular to the plane of the circle described by AG; and because AD, the line which describes the cylindric superficies, is parallel to GH, it is also perpendicular to the plane of that circle. (5. 7.). Now when by the revolution of the rectangle AGHD the point A coincides with the point E, the line EF will coincide with AD, and thus will be wholly in the cylindric superficies; for otherwise two perpendiculars might be drawn to the same plane, from the same point, which is impossible (2 cor. 4. 7.).

Theorem II.

Fig. 149. A cylinder and a parallelopiped having equivalent bases and the same altitude are equal to one another.

Let ABCD be a cylinder, and EF a parallelopiped having equivalent bases, viz. the circle AGB and the parallelogram EH, and having also equal altitudes; the cylinder ABCD is equal to the parallelopiped EF. If not, let them be unequal; and first let the cylinder be less than the parallelopiped EF; and from the parallelopiped EF let there be cut off a part EQ by a plane PQ parallel to NF, equal to the cylinder ABCD. In the circle AGB inscribe the polygon AGKBLM that shall differ from the circle by a space less than the parallelogram PH, (1 cor. 2. 6.) and cut off from the parallelogram EH a part OR equal to the polygon AGKBLM, then it is manifest that the parallelogram OR is greater than the parallelogram OP, therefore the point R will fall between P and N. On the polygon AGKBLM let an upright prism be constituted of the same altitude with the cylinder, which will therefore be less than the cylinder, because it is within it; (1.) and if through the point R a plane RS parallel to NF be made to pass, it will cut off the parallelopiped ES equal to the prism AGBC, because its base is equal to that of the prism, and its altitude is the same. But the prism AGBC is less than the cylinder ABCD, and the cylinder ABCD is equal to the parallelopiped EQ, by hypothesis; therefore, ES is less than EQ, and it is also greater, which is impossible. The cylinder ABCD therefore is not less than the parallelopiped EF; and in the same manner it may be shewn not to be greater than EF, therefore they are equal.

Theorem III.

If a cone and cylinder have the same base and the same altitude, the cone is the third part of the cylinder. Fig. 150.

Let the cone ABCD, and the cylinder BFKG have the same base, viz. the circle BCD, and the same altitude, viz. the perpendicular from the point A upon the plane BCD; the cone ABCD is the third part of the cylinder BFKG. If not, let the cone ABCD be the third part of another cylinder LMNO having the same altitude with the cylinder BFKG; but let the bases BCD, LIM be unequal, and first let BCD be greater than LIM. Then, because the circle BCD is greater than the circle LIM, a polygon may be inscribed in BCD that shall differ from it less than LIM does, (1. cor. 2. 6.) and which therefore will be greater than LIM. Let this be the polygon BECFD; and upon BECFD let there be constituted the pyramid ABECFD, and the prism BCFKHG. Because the polygon BECFD is greater than the circle LIM, the prism BCFKHG is greater than the cylinder LMNO, for they have the same altitude, but the prism has the greater base. But the pyramid ABECFD is the third part of the prism BCFHG (16. 8.); therefore it is greater

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greater than the third part of the cylinder LMNO. Now the cone ABECFD is by hypothesis the third part of the cylinder LMNO, therefore, the pyramid ABECFD is greater than the cone ABCD, and it is also less, because it is inscribed in the cone, which is impossible. Therefore the cone ABCD is not less than the third part of the cylinder BFKG. And in the same manner, by circumscribing a polygon about the circle BCD, it may be shewn, that the cone ABCD is not greater than the third part of the cylinder BFKG; therefore, it is equal to the third part of the cylinder.

Theorem IV.

Fig. 151.

If a hemisphere and cone have equal bases and altitudes, a series of cylinders may be inscribed in the hemisphere, and another series may be circumscribed about the cone, having all the same altitudes with one another, and such that their sum shall differ from the sum of the hemisphere and the cone by a solid, less than any given solid.

Let ADB be a semicircle, of which the centre is C, and let CD be at right angles to AB; let DB and DA be squares described on DC, draw CE, and let the figure thus constructed revolve about DC: then the quadrant BCD will describe a hemisphere having C for its centre, and the triangle CDE will describe a cone having its vertex at C, and having for its base the circle described by DE, equal to that described by BC, which is the base of the hemisphere. Let W be a given solid, a series of cylinders may be described in the hemisphere ADB, and another described about the cone ECI, so that their sum shall differ from the sum of the hemisphere and cone, by a solid less than the solid W.

Upon the base of the hemisphere let a cylinder be constituted equal to W, and let its altitude be CX. Divide CD into such a number of equal parts, that each of them shall be less than CX; let these be CH, HG, GF and FD. Draw FN, GO, HP parallel to CB, meeting the circle in K, L, and M, and the straight line BE in Q, R, and S. Draw K*f*, L*g*, M*h*, perpendicular to GO, HP, and CB; and draw Q*q*, R*r*, S*s*, perpendicular to the same lines. It is evident that the figure being thus constructed, if the whole revolve about CD, the rectangles F*f*, G*g*, H*h*, will describe cylinders that will be circumscribed by the hemisphere BDA; and that the rectangles DN, F*q*, G*r*, H*s* will also describe cylinders that will circumscribe the cone ICE. Now it may be demonstrated, as was done of the prisms inscribed in a pyramid (14. 8.), that the hemisphere exceeds the sum of all the cylinders described within it, by a solid less than the cylinder generated by the rectangle HB, that is, by a solid less than W. In the same manner it may be demonstrated, that the sum of the cylinders circumscribing the cone ICE is greater than the cone by a solid less than the cylinder generated by the rectangle DN, that is, by a solid less than W. Therefore, since the sum of the cylinders inscribed in the hemisphere together with a solid less than W, is equal to the hemisphere; and since the sum of the cylinders described about the cone is equal to the cone together with a solid less than W; adding equals to equals, the sum of all the cylinders together with a solid less than W is equal to the hemisphere and cone together with a solid less than W; therefore, the difference between the whole of the cylinders, and the sum of the hemisphere and the cone, is equal to the difference of two solids, each of which is less than W; but this difference must also be less than W; therefore the difference between the two series of cylinders, and the sum of the hemisphere and cone is less than the given solid W.

Theorem V.

The same things being supposed as in last theorem, the sum of all the cylinders inscribed in the hemisphere, and described about the cone, is equal to a cylinder having the same base and altitude with the hemisphere. Fig. 151.

For, the same construction being supposed as in last theorem, let L be the point in which GO meets the circle ADB, then because CGL is a right angle, if CL be joined, the circles described with the radii CG and GL are equal to the circle described with the radius CL or GO (2. cor. 4. 6.). Now CG=GR, because CD=DE, therefore, the circles described by the revolution of the radii GR and GL about the point G are together equal to the circle described by the revolution of the radius GO about the same point G; therefore also the cylinders that stand upon the two first of these circles having the common altitude GH are equal to the cylinder which stands upon the remaining circle, and which has the same altitude GH. The cylinders described by the revolution of the rectangles G*g* and G*r* are therefore equal to the cylinder described by the rectangle GP. And as the same may be shewn of all the rest, the cylinders described by the rectangles H*h*, G*g*, F*f*, and by the rectangles H*s*, G*r*, F*q*, DN, are together equal to the cylinder described by DB, that is, to the cylinder having the same base and altitude with the hemisphere.

Theorem VI.

Every sphere is two-thirds of the circumscribing cylinder. Fig. 151.

Let the figure be constructed as in the two last theorems, and if the hemisphere described by the quadrant BDC be not equal to two-thirds of the cylinder described by the rectangle BD, let it be greater by the solid W. Then as the cone described by CDE is one-third of the cylinder described by BD, the cone and the hemisphere together will exceed the cylinder by W. But that cylinder is equal to the sum of all the cylinders described by the rectangle H*h*, G*g*, F*f*, H*s*, G*r*, F*q*, DN; therefore, the hemisphere and the cone added together exceed the sum of all these cylinders by the solid W, which is absurd; for it has been shewn (4.) that the hemisphere and the cone together differ from the sum of these cylinders by a solid less than W. The hemisphere is therefore equal to two-thirds of the cylinder described

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scribed by the rectangle BD; and therefore the whole sphere is two thirds of the cylinder described by twice the rectangle BD, that is, to two-thirds of the circumscribing cylinder.

We here conclude the *Elements of Geometry*. Their application, constituting what is sometimes called *Practical Geometry*, will be given under the article Mensuration.

A Table shewing the Theorem of the foregoing Treatise, that corresponds to each of the most material Propositions in the first six, and in the eleventh and twelfth, books of *Euclid's Elements*.

Euclid.	Geometry.
Book I.	Theor. Sect.
Prop. 4.	5. 1.
5.	11. 1.
6.	12. 1.
8.	10. 1.
13.	1. 1.
14.	3. 1.
15.	4. 1.
16.	23. 1.
17.	24. 1.
18. 19.	13. 1.
20.	7. 1.
21.	8. 1.
24. 25.	9. 1.
26.	6. 1.
27. 28.	22. 1.
29.	21. 1.
30.	20. 1.
32.	23. 24. 25. 1.
33.	28. 1.
34.	26. 1.
35. 36.	1. 4.
37. 38.	2 cor. to 2. 4.

Euclid.	Geometry.
Book I.	Theor. Sect.
Pr. 41.	2. 4.
47.	13. 4.
48.	scholium 15. 4.
Book II.	Theor. Sect.
Pr. 4.	10. 4.
5.	12. 4.
7.	11. 4.
12.	15. 4.
13.	14. 4.
Book III.	Theor. Sect
Pr. 3.	6. 2.
10.	cor. 7. 2.
11.	12. 2.
12.	11. 2.
14.	8. 2.
15.	2. 2. 8. 2.
16.	9. 2.
20.	14. 2.
21.	15. 2.
22.	16. 2.
26. 27.	13. 2.

Euclid.	Geometry.
Book III.	Theor. Sect.
Pr. 28. 29.	4. 2.
31.	17. 2.
32.	18. 2.
35.	28. 4.
36.	29. 4. 30. 4.
Book V.	Theor. Sect.
Pr. 4.	5. 3.
12.	8. 3.
15.	1. 3.
16.	2. 3.
17. 18. 19.	4. 3.
22.	6. 3.
23.	7. 3.
24.	8. 3.
Book VI.	Theor. Sect.
Pr. 1.	cor. 5. 4. cor. 6. 4.

Euclid.	Geometry.
Book VI.	Theor. Sect
Pr. 2.	17. 4. 18. 4.
3.	19. 4.
4.	20. 4.
5.	21. 4.
6.	22. 4.
8.	23. 4. cor.
14. 15.	24. 4.
16. 17.	8. 4.
19.	25. 4.
20.	26. 4. 27. 4.
31.	1 cor. 27. 4.
33.	31. 4.
Book XI.	Theor. Sect.
Pr. 1.	1. 7.
3.	3. 7.
4.	4. 7.
6.	1 cor. 5. 7.
8.	5. 7.

Euclid.	Geometry.
Book XI.	Theor. Sect.
9.	2 cor. 5. 7.
10.	10. 7.
13.	2 cor. 4. 7.
14.	6. 7.
15.	10. 7.
16.	7. 7.
17.	14. 7.
18.	11. 7.
19.	13. 7.
20.	20. 7.
24.	2. 8.
25.	8. 8.
28.	3. 8.
29.	4. 8.
30. 31.	5. 8.
32.	9. 8.
33.	12. 8.
Book XII.	Theor. Sect.
Pr. 1.	1. 6.
2.	4. 6.
7.	16. 8.
10.	3. 9.

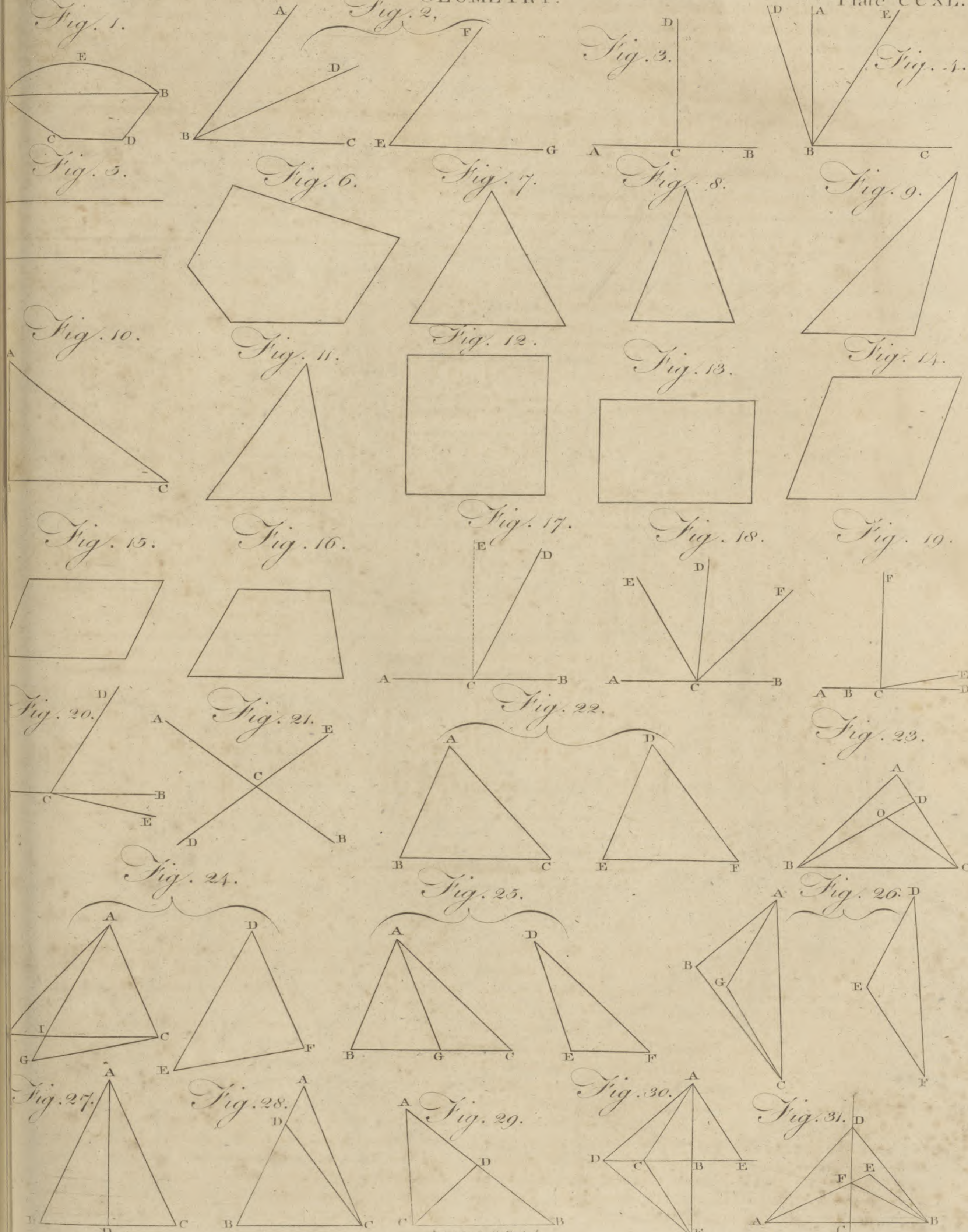
George.

GEORGE I. II. and III. kings of Great Britain.—George I. the son of Ernest Augustus, duke of Brunswick Lunenburgh, and elector of Hanover, succeeded to the throne of Great Britain in 1714, in virtue of an act of parliament, passed in the latter part of the reign of King William III. limiting the succession of the crown, after the demise of that monarch, and Queen Anne (without issue), to the princess Sophia of Hanover, and the heirs of her body, being Protestants.—George II. the only son of the former, succeeded him in 1727, and enjoyed a long reign of glory; dying amidst the most rapid and extensive conquests in the 77th year of his age. He was succeeded by his grandson George III. our late sovereign. For particulars, see Britain, N° 374—701.

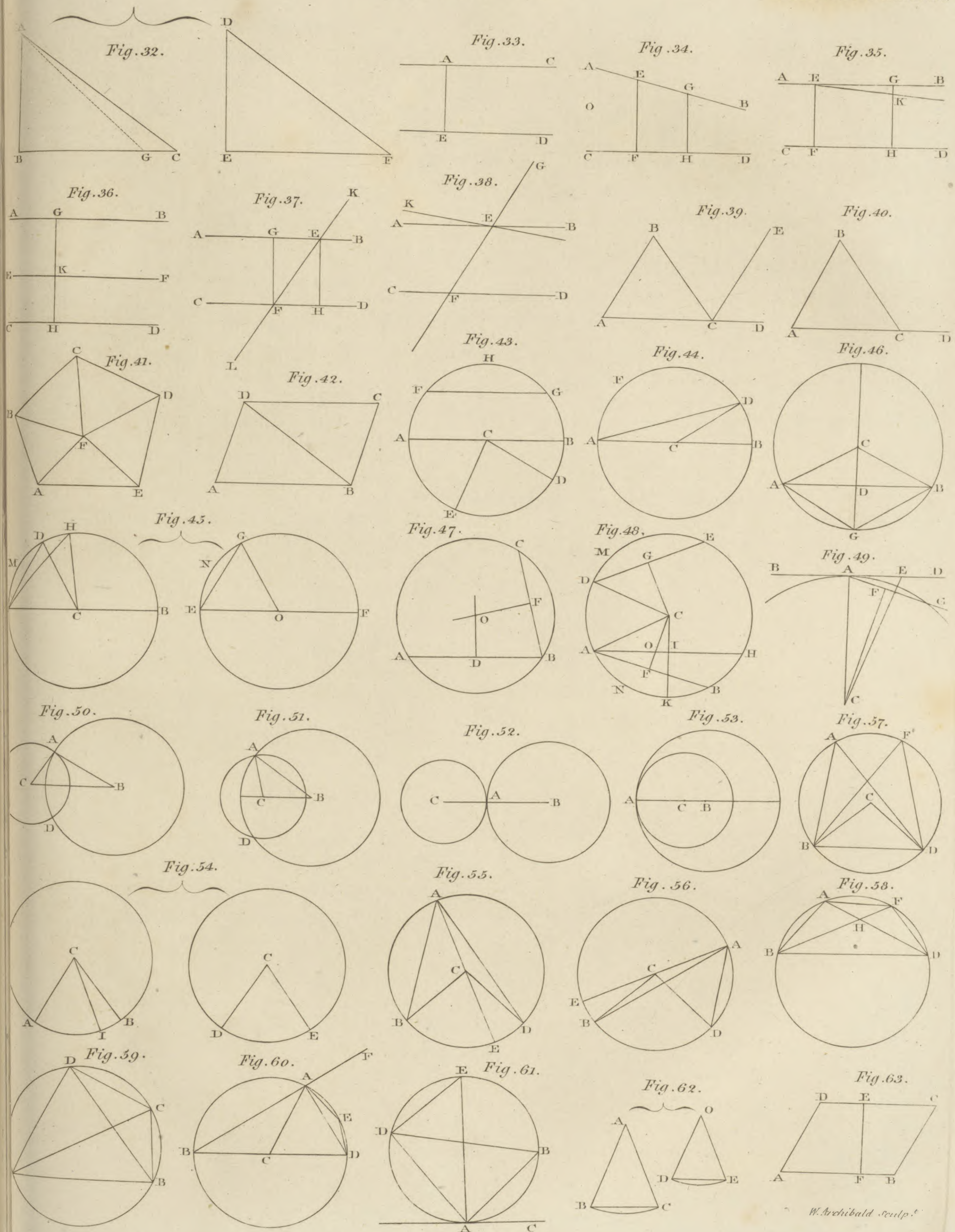
G E O

George, or *Knights of St George*, has been the denomination of several military orders, whereof that of the Garter is one of the most illustrious. See Garter, and *St George*, below.

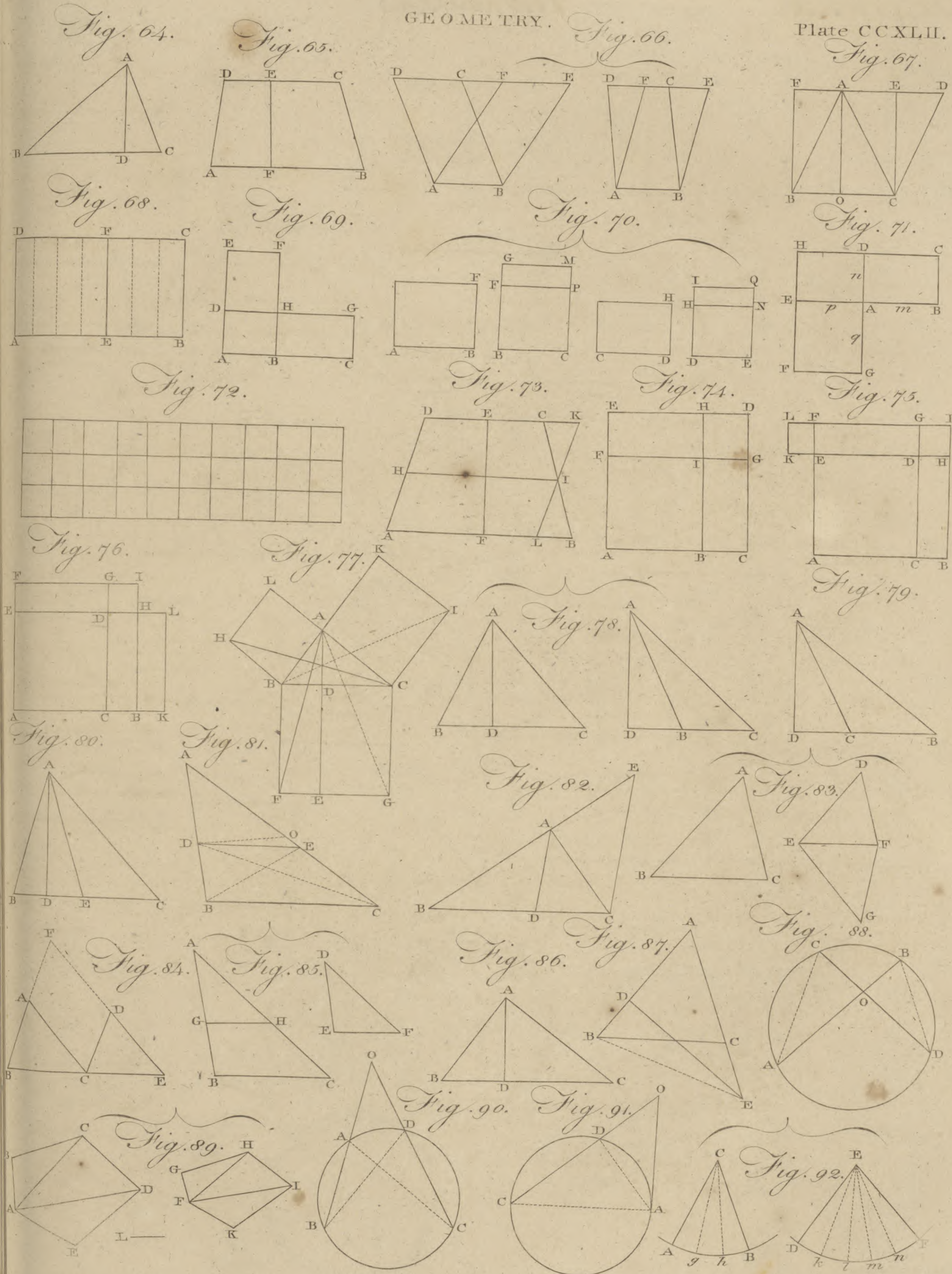
King George's Islands, are two islands in the South sea, lying in W. Long. 144. 56. S. Lat. 14. 28. They were first discovered by Commodore Byron in 1765, and were since visited by Captain Cook in 1774. Commodore Byron's people had an encounter with the inhabitants, which proved fatal to some of the natives; but Captain Cook was more fortunate. A lieutenant and two boats well-armed were sent on shore by Captain Cook; and landed without opposition. As soon as the gentlemen landed, the islanders embraced them by touching noses, a mode of civility used in New Zealand,



E. Mitchell sculpt.



W. Archibald Sculp.



A. Bell Prin. Wal. Sculptor fecit.

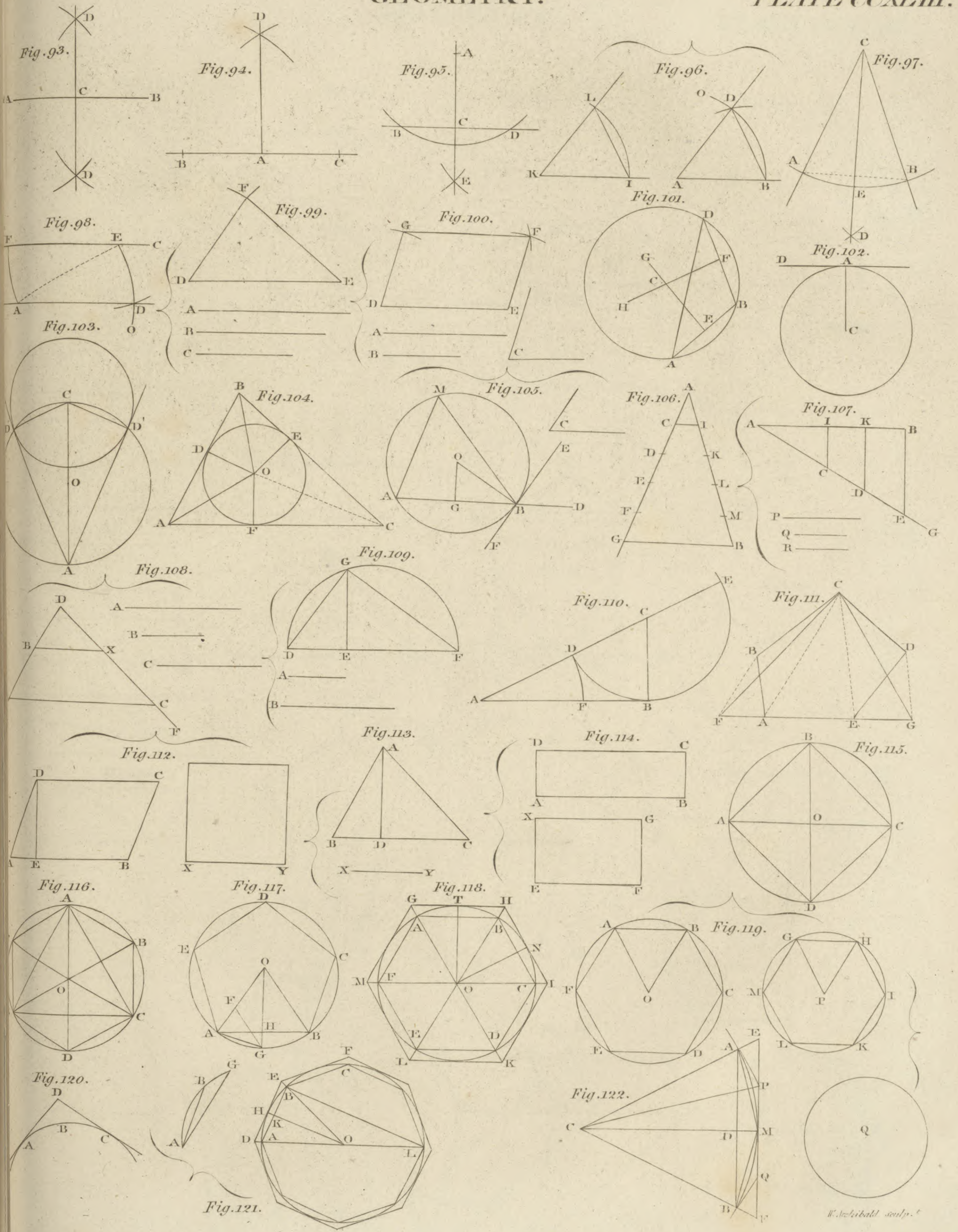


Fig. 93.
Fig. 94.
Fig. 95.
Fig. 96.
Fig. 97.
Fig. 98.
Fig. 99.
Fig. 100.
Fig. 101.
Fig. 102.
Fig. 103.
Fig. 104.
Fig. 105.
Fig. 106.
Fig. 107.
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Fig. 118.
Fig. 119.
Fig. 120.
Fig. 121.
Fig. 122.
W. Archibald sculp.

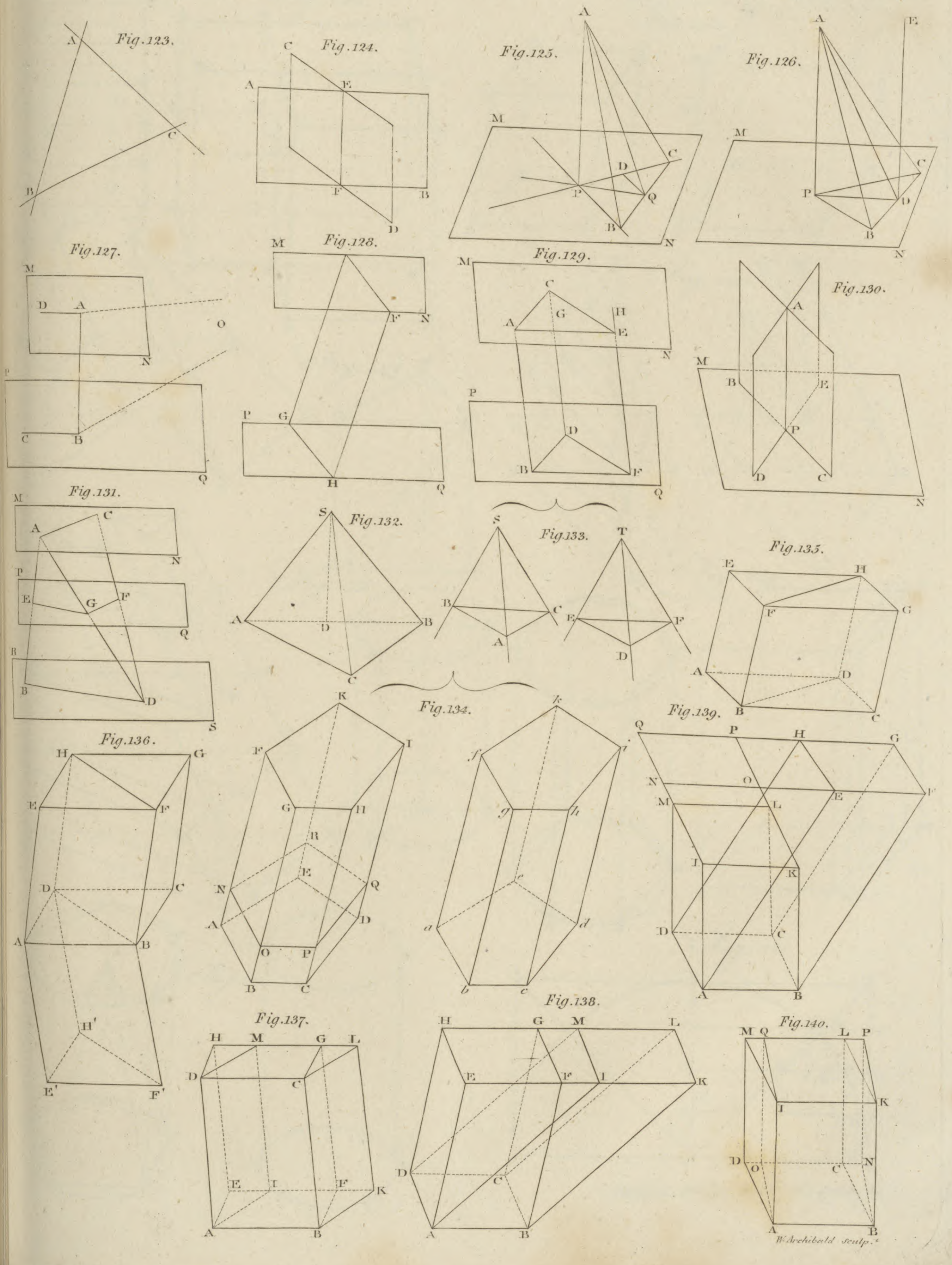
Fig. 123.
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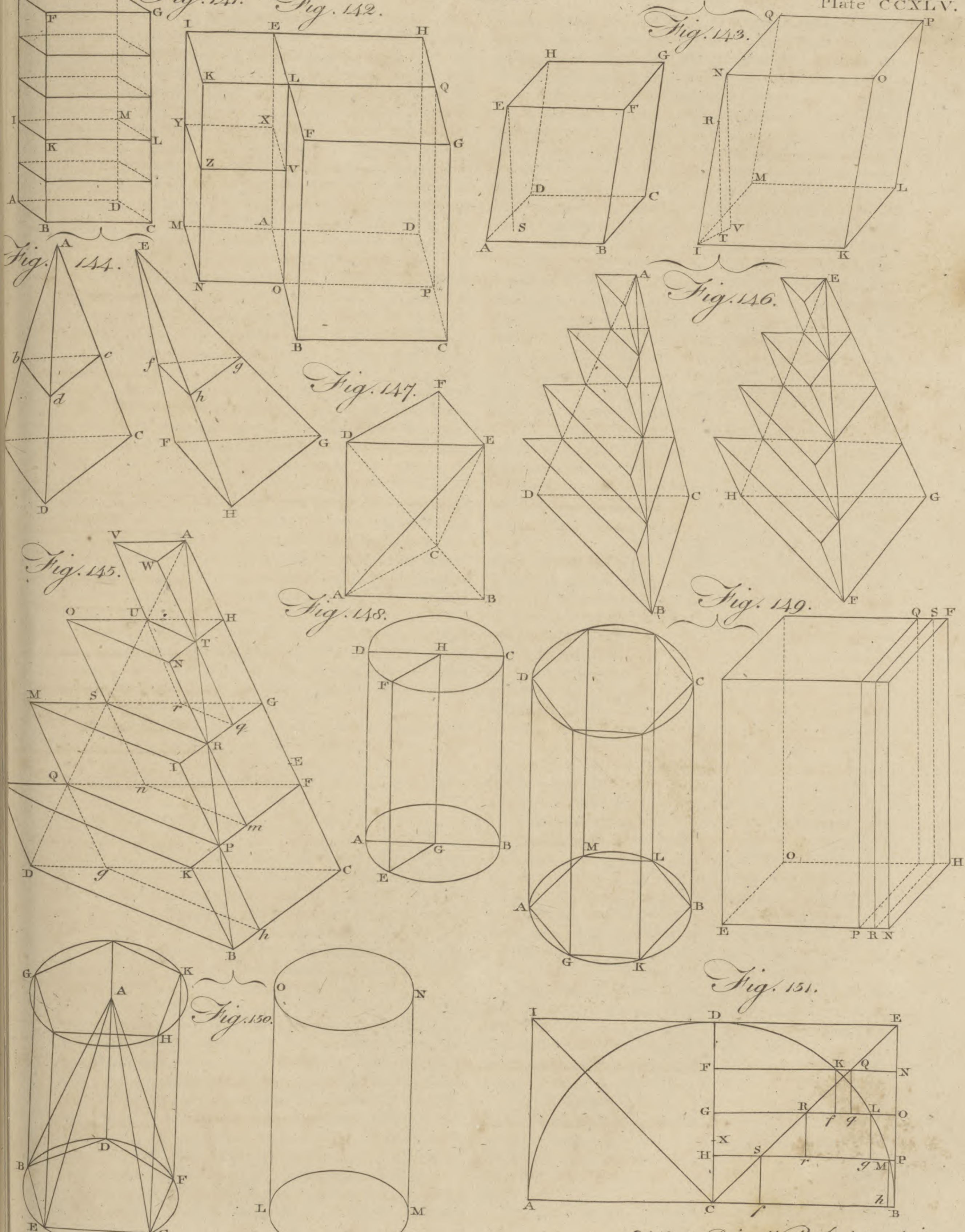
Fig. 140.
W. Archibald sculp.



A. Bell Prin. Wal. Sculptor fecit.

George. land, which is 900 leagues distant, and the only place besides this where the custom has been observed to prevail. Notwithstanding this ceremony, however, very little real friendship seemed to take place on the part of the islanders. They crowded about the boats as the people were stepping into them, and seemed in doubt whether they should detain them or let them go; at last, however, not thinking themselves sufficiently strong, they seemed contented with their departure, and assisted them in pushing off their boats; but some of the most turbulent threw stones into the water, which fell very near them, and all seemed to glory that they had as it were driven them off. The British brought off five dogs of a white colour with fine long hair, with which the island seemed to be plentifully supplied. These they purchased with small nails, and some ripe bananas which had been brought from the Marquesas. On this island Mr Forster found a kind of scurvy-grass, which the natives informed him they were wont to bruise and mix with shell fish; after which, they threw it into the sea whenever they perceived a shoal of fish. This preparation intoxicates them for some time; and thus they are caught on the surface of the water without any other trouble than that of taking them out. The name of this plant among the natives is *enow*. The largest island, which they call *Tiookea*, is something of an oval shape, and about 10 leagues in circuit; the other island, which lies two leagues to the westward of Tiookea, is four leagues long from north-east to south-west, and from three to five miles broad. The soil of both is extremely scanty; the foundation consists of coral, very little elevated above the surface of the water.

George, St, or *George of Cappadocia;* a name whereby several orders, both military and religious, are denominated. It took its rise from a saint or hero famous throughout all the East, called by the Greeks *Μεγαλομαρτυς*, q. d. *great martyr*.

On some medals of the emperors John and Manuel Comneni, we have the figure of St George armed, holding a sword or javelin in one hand, and in the other a buckler, with this inscription; an O, and therein a little

P

A, and ΓΕ—ΓΙΟC, making Ο ΑΓΙΟΣ ΓΕΟΡΓΙΟΣ, *O*

O

holy George. He is generally represented on horseback, as being supposed to have frequently engaged in combats in that manner. He is highly venerated throughout Armenia, Muscovy, and all the countries which adhere to the Greek rite: from the Greek, his worship has long ago been received into the Latin church; and England and Portugal have both chosen him for their patron saint.

Great difficulties have been raised about this saint or hero. His very existence has been called in question. Dr Heylin, who wrote first and most about him, concluded with giving him entirely up, and supposing him only a symbolical device; and Dr Pettingal has turned him into a mere Basilidian symbol of victory. Mr Pegg, in a paper in the Archæologia *, has attempted to restore him. And, finally, Mr Gibbon † has sunk him into an Arian bishop in the reigns of Constantius and Julian.—The bishop alluded to,

* Vol. i.

† [...]. Hist. [...] ii. [...]04.

George the Cappadocian, was so surnamed, according to our author, from his parents or education; and was born at Epiphania in Cilicia, in a fuller's shop. "From this obscure and servile origin he raised himself by the talents of a parasite: and the patrons, whom he assiduously flattered, procured for their worthless dependent a lucrative commission or contract, to supply the army with bacon. His employment was mean: he rendered it infamous. He accumulated wealth by the basest arts of fraud and corruption; but his malversations were so notorious, that George was compelled to escape from the pursuits of justice. After this disgrace, in which he appears to have saved his fortune at the expence of his honour, he embraced, with real or affected zeal, the profession of Arianism. From the love, or the ostentation, of learning, he collected a valuable library of history, rhetoric, philosophy, and theology; and the choice of the prevailing faction promoted George of Cappadocia to the throne of Athanasius." His conduct in this station is represented by our historian as polluted by cruelty and avarice, and his death considered as a just punishment for the enormities of his life, among which Mr Gibbon seems to rank his "enmity to the gods."

The immediate occasion of his death, however, as narrated by ecclesiastical writers, will not probably appear calculated to add any stain to his memory. "There was in the city of Alexandria a place in which the heathen priests had been used to offer human sacrifices. This place, as being of no use, Constantius gave to the church of Alexandria, and George the bishop gave orders for it to be cleared, in order to build a Christian church on the spot. In doing this they discovered an immense subterraneous cavern, in which the heathen mysteries had been performed, and in it were many human skulls. These, and other things which they found in the place, the Christians brought out and exposed to public ridicule. The heathens, provoked at this exhibition, suddenly took arms and rushing upon the Christians, killed many of them with swords, clubs and stones: some also they strangled, and several they crucified. On this the Christians proceeded no farther in clearing the temple; but the heathens, pursuing their advantage, seized the bishop as he was in the church, and put him in prison. The next day they despatched him; and then fastening the body to a camel, he was dragged about the streets all day, and in the evening they burnt him and the camel together. This fate, Sozomen says, the bishop owed in part to his haughtiness while he was in favour with Constantius, and some say the friends of Athanasius were concerned in this massacre; but he ascribes it chiefly to the inveteracy of the heathens, whose superstitions he had been very active in abolishing.

This George, the Arian bishop of Alexandria, was a man of letters, and had a very valuable library, which Julian ordered to be seized for his own use; and in his orders concerning it, he says that many of the books were on philosophical and rhetorical subjects, though many of them related to the doctrine of the impious Galileans (as in his sneering contemptuous way he always affected to call the Christians). 'These books (says he) I could wish to have utterly destroyed; but lest books of value should be destroyed along with them, let those also be carefully sought for.'

But Mr Gibbon gives a different turn to the affair of of George's murder, as well as relates it with different circumstances. "The Pagans (says he) excited his devout avarice; and the rich temples of Alexandria were either pillaged or insulted by the haughty prelate, who exclaimed, in a loud and threatening tone, 'How long will these sepulchres be permitted to stand?' Under the reign of Constantius, he was expelled by the fury, or rather by the justice of the people: and it was not without a violent struggle, that the civil and military powers of the state could restore his authority, and gratify his revenge. The messenger who proclaimed at Alexandria the accession of Julian, announced the downfal of the archbishop. George, with two of his obsequious ministers, Count Diodorus and Darcontius master of the mint, was ignominiously dragged in chains to the public prison. At the end of 24 days, the prison was forced open by the rage of a superstitious multitude, impatient of the tedious forms of judicial proceedings. The *enemies of gods* and men expired under their cruel insults; the lifeless bodies of the archbishop and his associates were carried in triumph through the streets on the back of a camel; and the inactivity of the Athanasian party was esteemed a shining example of evangelical patience. The remains of these guilty wretches were thrown into the sea; and the popular leaders of the tumult declared their resolution to disappoint the devotion of the Christians, and to intercept the future honours of these martyrs, who had been punished like their predecessors, by the enemies of their religion. The fears of the Pagans were just, and their precautions ineffectual. The meritorious death of the archbishop obliterated the memory of his life. The rival of Athanasius was dear and sacred to the Arians, and the seeming conversion of those sectaries introduced his worship into the bosom of the Catholic church. The odious stranger, disguising every circumstance of time and place, assumed the mask of a martyr, a saint, and a Christian hero; and the infamous George of Cappadocia has been transformed into the renowned St George of England, the patron of arms, of chivalry, and of the Garter."

Knights of St George. See GARTER. There have been various other orders under this denomination, most of which are now extinct; particularly one founded by the emperor Frederic III. in the year 1470, to guard the frontiers of Bohemia and Hungary against the Turks; another, called *St George of Alfama*, founded by the kings of Arragon; another in Austria and Carinthia; and another in the republic of Genoa, still subsisting, &c.

Religious of St George. Of these there are divers orders and congregations; particularly canons regular of St George in Alga, at Venice, established by authority of Pope Boniface IX. in the year 1404. The foundation of this order was laid by Bartholomew Colonna, who preached in 1396, at Padua, and some other villages in the state of Venice. Pope Pius V. in 1570, gave these canons precedence of all other religious. Another congregation of the same institute in Sicily, &c.

St George del Mina, the capital of the Dutch settlements on the Gold coast of Guinea, situated seven or eight miles west of Cape-coast castle the capital of the British settlements there. W. Long. 5'. and N. Lat. 5°.

St George, a fort and town of Asia, in the peninsula on this side the Ganges, and on the coast of Coromandel, belonging to the British; it is otherwise called *Madras*, and by the natives *Chilipatam*. It fronts the sea, and has a salt water river on its back side, which hinders the fresh water springs from coming near the town, so that they have no good water within a mile of them. In the rainy seasons it is incommoded by inundations; and from April to September, it is so scorching hot, that if the sea breezes did not cool the air, there would be no living there. There are two towns, one of which is called the *White Town*, which is walled round, and has several bulwarks and bastions to defend it: it is 400 paces long and 150 broad, and is divided into regular streets. Here are two churches, one for the Protestants, and the other for the Papists; as also a good hospital, a town hall, and a prison for debtors. They are a corporation, and have a mayor and aldermen, with other proper officers. The *Black Town* is inhabited by Gentoos, Mahometans, and Portuguese and Armenian Christians, and each religion has its temples and churches. This, as well as the White Town, is ruled by the English governor and his council. The diamond mines are but a week's journey from this place, which renders them pretty plentiful, but there are no large ones since that great diamond was procured by Governor Pitt. This colony produces very little of its own growth or manufacture for foreign markets, and the trade is in the hands of the Armenians and Gentoos. The chief things the British deal in, besides diamonds, are calicoes, chintz, muslins, and the like. In 1794 the population of the town was estimated at 300,000. Their rice is brought by sea from Gangam and Orixa, their wheat from Surat and Bengal, and their fire wood from the islands of Diu; so that an enemy, with a superior force at sea, may easily distress them. The houses of the White Town are built with brick, and have lofty rooms and flat roofs. The houses in the *White Town* have all green Venetian windows, and are surrounded by gardens. The Black Town consists chiefly of thatched cottages. The military power is lodged in the governor and council, who are also the last resort in civil causes. The company have two chaplains, who officiate by turns. They never attempt to make proselytes, but leave that to the Popish missionaries. The salaries of the Company's writers are very small: but if they have any fortune of their own, they may make it up by trade; which must generally be the case, for they commonly grow rich. It was taken by the French in 1764, who restored it at the peace of Aix-la-Chapelle.

St George's, the largest of the Bermuda or Summer islands. W. Long. 65. 10. N. Lat. 32. 30.

Cross of St George, a red one in a field argent, which makes part of the British standard.

GEORGE, a lake in America in the state of New York, about 35 miles long, and from one to seven broad. There are some beautiful islands in it, the largest of which is about two miles broad, commanding a delightful and very extensive prospect. There are manifest traces of a large town of the aborigines, and the-

the island itself appears to have been the favourite residence of an Indian prince. It lies to the south of Lake Champlain, and its waters lie about 100 feet higher. It abounds with fishes of a superior quality, such as the Oswego bass, and speckled trouts of considerable magnitude. The French at one period called it Lake Sacrament, as they were at the trouble to bring from it their water for sacramental purposes, to the churches they had planted in Canada.

GEORGETOWN, the name of several towns in America, such, for instance, as Georgetown in Maryland, about 65 miles S. W. of Philadelphia; Georgetown in the county of Lincoln, and district of Maine, lying on both sides of Kennebeck river, 148 miles S. W. of Philadelphia, where the Roman Catholics have a very flourishing college: it is the name of a village in Fayette county, Pennsylvania, where a number of boats are annually built; and of a post town in the district of the same name, where the Episcopalians, Baptists, and Methodists, have each a place of worship. It is also the name of a port of entry in South Carolina, situated on the Sampit river, 12 miles from the sea. It has a flourishing academy, where orphans and poor children are educated gratis.

GEORGIA, a country of Asia, bounded on the north by Circassia, on the east by Daghestan and Shirvan, on the south by Armenia, and on the west by the Euxine or Black sea; comprehending the greatest part of the ancient Colchis, Iberia, and Albania. About the etymon of the name of this country, authors are not agreed. The most probable opinion is, that it is a corruption by softening of *Kurgia*, from the river Kur; whence also it is supposed that the inhabitants are called by the Persians indifferently *Gurgi* and *Kurgi*; and the country *Kurgistan* and *Gurgistan*: It is divided by a ridge of mountains into eastern and western; the former of which is again subdivided into the kingdoms of Caket, Carduel or Carthuel, and Goguetia; and the latter into the provincess of Abcassia, Mireta or Imeretia, and Guriel. Another division is into Georgia Proper, Abcassia, and Mingrelia. A third division will be afterwards mentioned.

"Georgia, (says Sir George Chardin) is as fertile a country as can be seen; the bread is as good here as in any part of the world; the fruit of an exquisite flavour and of different sorts: no place in Europe yields better pears and apples, and no place in Asia better pomegranates. The country abounds with cattle, venison, and wild fowl of all sorts: the river Kur is well stocked with fish; and the wine is so rich, that the king of Persia has always some of it for his own table. The inhabitants are robust, valiant, and of a jovial temper; great lovers of wine, and esteemed very trusty and faithful; endowed with good natural parts, but, for want of education, very vicious. The women are generally so fair and comely, that the wives and concubines of the king of Persia and his court are for the most part Georgian women. Nature has adorned them with graces nowhere else to be met with: it is impossible to see them without loving them; they are of a good size, clean limbed, and well shaped. Another traveller, however, of no mean character, thus expresses himself with respect to the women: "As to the Georgian women, they did not at all surprise us; for we expected to find them perfect beauties. They are, indeed no way disagreeable; and may be counted beauties, if compared with the Curdes. They have an air of health that is pleasing enough; but, after all, they are neither so handsome nor so well shaped as is reported. Those who live in the towns have nothing extraordinary more than the others; so that I may, I think, venture to contradict the accounts that have been given of them by most travellers."

This country formerly abounded with great cities, as appears not only from its history, but from the ruins of many of them still visible, which show that they must have been very large, opulent, and magnificently built. These were all destroyed by the inundations of northern barbarians from Mount Caucasus, as the Alans, Huns, Suevi, and some others, so much noted in history for their strength, courage, and conquests.

The latest division of this country is into nine provinces; five of which were subject to the famous prince Heraclius, forming what is commonly called the kingdom of Georgia; and four were under the dominion of David, composing the kingdom or principality of Imeretia. See IMERETIA.

This whole country is so extremely beautiful, that some fanciful travellers have imagined they had here found the situation of the original garden of Eden. The hills are covered with forests of oak, ash, beech, chesnuts, walnuts, and elms, encircled with vines, growing perfectly wild, but producing vast quantities of grapes. From these is annually made as much wine as is necessary for the yearly consumption; the remainder is left to rot on the vines. Cotton grows spontaneously, as well as the finest European fruit trees. Rice, wheat, millet, hemp, and flax, are raised on the plains, almost without culture. The valleys afford the finest pasturage in the world; the rivers are full of fish; the mountains abound in minerals, and the climate is delicious; so that nature appears to have lavished on this favourite country every production that can contribute to the happiness of its inhabitants.

On the other hand, the rivers of Georgia being fed by mountain torrents, are at all seasons either too rapid or too shallow for the purposes of navigation: the Black sea, by which commerce and civilization might be introduced from Europe, has been till very lately in the exclusive possession of the Turks: the trade of Georgia by land is greatly obstructed by the high mountains of Caucasus; and this obstacle is still increased by the swarms of predatory nations, by which those mountains are inhabited.

It is said, that in the 15th century, a king of Georgia divided among his five sons the provinces of Carduel and Caket, Imeretia, Mingrelia, Guriel, and Abcassia. These petty princes were too jealous to unite for their common defence, and too weak singly to resist a foreign enemy, or even to check the encroachments of their great vassals, who soon became independent. By forming a party among these nobles, the Turks gradually gained possession of all the western provinces, while the Persians occupied the governments of Carduel and Caket. Since that period the many unsuccessful attempts of the Georgians to recover their liberty have repeatedly produced the devastation of their country. Abbas the Great is said to have carried off in one expedition from the provinces of

Georgia. of Carduel and Caket no less than 80,000 families; a number which, probably, exceeds the whole actual population of those provinces. The most horrible cruelties were again exercised on the unhappy people, at the beginning of the present century, by the merciless Nadir; but these were trifling evils, compared with those arising from the internal dissensions of the great barons. This numerous body of men, idle, arrogant, and ferocious, possessed of an unlimited power over the lives and properties of their vassals, having no employment but that of arms, and no hopes of aggrandizing themselves but by the plunder of their rivals, were constantly in a state of warfare; and as their success was various, and the peasants of the vanquished were constantly carried off and sold to the Turks or Persians, every expedition increased the depopulation of the country. At length they invited the neighbouring mountaineers, by the hopes of plunder, to take part in their quarrels; and these dangerous allies, becoming acquainted with the country, and being spectators of the weakness of its inhabitants, soon completed its desolation. A few squalid wretches, half naked, half starved, and driven to despair by the merciless exactions of their landlords, are thinly dispersed over the most beautiful provinces of Georgia. The revolutions of Persia, and the weakness of the Turks, indeed enabled the princes of the country to recover their independence; but they did not long enjoy this advantage, as they have recently been subdued by the Russians, and the country now forms a province of that unwieldy empire.

The capital of Georgia is Teflis, where Prince Heraclius resided (See Teflis). Of this prince, so celebrated for his exploits and success in shaking off the Ottoman yoke, we have the following account by the late Professor Guldenstaedt when he travelled into these parts in 1770. "Heraclius, or, as he is called, the Tzar Iracli, is above 60 years old, of a middle size, with a long countenance, a dark complexion, large eyes, and a small beard. He passed his youth at the court and in the army of the celebrated Nadir Shah, where he contracted a fondness for Persian customs and manners, which he has introduced into his kingdom. He has seven sons and six daughters. He is much revered and dreaded by the Persian khans his neighbours; and is usually chosen to mediate between them in their disputes with each other. When they are at war, he supports one of the parties with a few troops, who diffuse a spirit and courage among the rest, because the Georgian soldiers are esteemed the bravest of those parts; and Prince Heraclius himself is renowned for his courage and military skill. When on horseback he has always a pair of loaded pistols at his girdle, and, if the enemy is near, a musket slung over his shoulder. In all engagements he is the foremost to give examples of personal bravery; and frequently charges the enemy at the head of his troops with the sabre in his hand. He loves pomp and expence; he has adopted the dress of Persia; and regulates his court after the manner of that country. From the example of the Russian troops, who were quartered in Georgia during the last Turkish war, he has learnt the use of plates, knives, and forks, dishes and household furniture, &c."

The subjects of Heraclius were estimated at about 60,000 families; but this, notwithstanding the present desolated state of the country, is probably an under valuation. The peasants belonging to the queen, and those of the patriarch, pay no tax to the prince, and therefore do not appear on the books of the revenue officers. Many similar exemptions have likewise been granted by the prince to his sons-in-law, and his favourites. Besides, as the impost on the peasants is not a poll-tax, but a tax on hearths, the inhabitants of a village, on the approach of the collectors, frequently carry the furniture of several huts into one, and destroy the remainder, which are afterwards very easily replaced. It is probable, therefore, that the population of Georgia does not fall short of 350,000 souls. The revenues may be estimated at about 150,000 rubles, or 26,250l. They consist of, 1. The customs, farmed at 1750l.—2. Rent paid by the farmers of the mint, at Teflis, 1750l.—3. The tribute paid by the khans of Erivan and Gansha, 7000l.—and, 4. The hearth money levied on the peasants, amounting to 15,750l. The common coins here are the abasses, of about 15d. value, and a small copper coin, stamped at the mint at Teflis. Besides these, a large quantity of gold and silver money is brought into the country from Persia and Turkey, in exchange for honey, butter, cattle, and blue linens.

The government of Georgia was despotic; and though now subject to Russia, it is still in a great measure governed by its own laws. The punishments in criminal cases are shockingly cruel; fortunately they are not frequent, because it is seldom difficult to escape into some of the neighbouring countries, and because the prince is more enriched by confiscating the property of the criminal, than by putting him to torture. Judicial combats are considered as the privilege of nobility, and take place when the cause is extremely intricate, or when the power and interest of two claimants are so equal, that neither can force a decision of the court in his favour. This mode of trial is called an appeal to the judgment of God.

The dress of the Georgians nearly resembles that of the Cossacks; but men of rank frequently wear the habit of Persia. They usually dye their hair, beard, and nails with red. The Georgian women employ the same colour to stain the palms of their hands. On their heads they wear a cap or fillet, under which their black hair falls on their forehead: behind it is braided into several tresses. Their eyebrows are painted with black, in such a manner as to form one entire line, and their faces are perfectly coated with white and red. Their robe is open to the girdle, so that they are reduced to conceal their breasts with their hands. Their air and manner are extremely voluptuous. Being generally educated in convents, they can all read and write; a qualification which is very unusual among the men, even of the highest rank. Girls are betrothed as soon as possible, often at three or four years of age. In the streets the women of rank are always veiled, and then it is indecent in any man to accost them. It is likewise uncivil in conversation to inquire after the wives of any of the company. These, however, are not ancient customs, but are a consequence of the violences committed by the Persians, under Shah Nadir.

Travellers

Travellers accuse the Georgians of drunkenness, superstition, cruelty, sloth, avarice, and cowardice; vices which are everywhere common to slaves and tyrants, and are by no means peculiar to the natives of this country. The descendants of the colonists, carried off by Shah Abbas, and settled at Peria, near Ispahan, and in Masanderan, have changed their character with their government; and the Georgian troops, employed in Persia against the Affghans, were advantageously distinguished by their docility, their discipline, and their courage.

The other inhabitants of Georgia are Tartars, Ossi, and Armenians, called in the Georgian language Somakhi. These last are found all over Georgia, sometimes mixed with the natives, and sometimes in villages of their own. They speak among themselves their own language, but all understand and can talk the Georgian. Their religion is partly the Armenian, and partly the Roman Catholic. They are the most oppressed of the inhabitants, but are still distinguished by that instinctive industry which everywhere characterizes the nation.

Besides these, there are in Georgia considerable numbers of Jews, called, in the language of the country, Uria. Some have villages of their own; and others are mixed with the Georgian, Armenian, and Tartar inhabitants, but never with the Ossi. They pay a small tribute above that of the natives.

Georgia, one of the United States of America, lying between South Carolina and Florida. It is about 290 miles long from north to south, 250 broad, and its area is about 62,000 square miles. It is bounded by Florida on south, the Atlantic on the east, Alabama on the west, and South Carolina on the north. The whole coast is bordered with islands; the principal of which are Skidaway, Wassaw, Sapelo, Frederica, Jekyl, Cumberland, and Amelia.

The settlement of a colony between the rivers Savannah and Alatamaha was meditated in England in 1732, for the accommodation of poor people in Great Britain and Ireland, and for the further security of Carolina. Private compassion and public spirit conspired to promote the benevolent design. Humane and opulent men suggested a plan of transporting a number of indigent families to this part of America free of expence. For this purpose they applied to the king, George II. and obtained from him letters patent, bearing date June 9, 1732, for legally carrying into execution what they had generously projected. They called the new province *Georgia*, in honour of the king, who encouraged the plan. A corporation, consisting of 21 persons, was constituted by the name of, The Trustees for settling and establishing the colony of Georgia.

In November 1732, 116 settlers embarked for Georgia to be conveyed thither free of expence, furnished with every thing requisite for building and for cultivating the soil. Mr James Oglethorpe, one of the trustees, and an active promoter of the settlement, embarked as the head and director of these settlers. They arrived at Charlestown early in the next year. Mr Oglethorpe, accompanied by William Bull, shortly after his arrival, visited Georgia; and after surveying the country, marked the spot on which Savannah now stands, as the fittest to begin their settlement. Here they accordingly began and built a small fort, and a number of small huts for their defence and accommodation. Such of the settlers as were able to bear arms were embodied, and well appointed with officers, arms, and ammunition. A treaty of friendship was concluded between the settlers and their neighbours the Creek Indians, and every thing wore the aspect of peace and future prosperity. But the fundamental regulations established by the trustees of Georgia were ill adapted to the circumstances and situation of the poor settlers, and of pernicious consequences to the prosperity of the province. Yet although the trustees were greatly mistaken with respect to their plan of settlement, it must be acknowledged their views were generous. Like other distant legislators, who framed their regulations upon principles of speculation, they were liable to many errors and mistakes; and however good their design, their rules were found improper and impracticable. These injudicious regulations and restrictions, the wars in which they were involved with the Spaniards and Indians, and the frequent insurrections among themselves, threw the colony into a state of confusion and wretchedness too great for human nature long to endure. Their oppressed situation was represented to the trustees by repeated complaints; till at length finding that the province languished under their care, and weary with the complaints of the people, they in the year 1752 surrendered their charter to the king, and it was made a royal government. —In the year 1740, the Rev. George Whitefield founded an orphan house academy in Georgia about 12 miles from Savannah. Mr Whitefield died at Newbury port, in New England, in October 1770, in the 56th year of his age, and was buried under the Presbyterian church in that place. From the time Georgia became a royal government in 1752 till the peace of Paris in 1763, she struggled under many difficulties, arising from the want of credit and friends, and the frequent molestations of enemies. The good effects of the peace were sensibly felt in the province of Georgia. From this time it began to flourish under the fatherly care of Governor Wright. To form a judgment of the rapid growth of the colony, we need only attend to its exports. In the year 1763, they consisted of 7500 barrels of rice, 9633 pounds of indigo, 1250 bushels of Indian corn, which, together with deer and beaver skins, naval stores, provisions, timber, &c. amounted to no more than 27,021l. sterling. Ten years afterwards, in 1773, they amounted to 121,677l. sterling. The chief articles of export from this state are, rice, tobacco, indigo, sago, lumber of various kinds, naval stores, leather, deer skins, snake-root, myrtle, bees wax, corn, live stock, &c.

During the American war, Georgia was overrun by the British troops, and the inhabitants were obliged to flee to the neighbouring states for safety. Since the peace the progress of the population of this state is said to have been astonishingly rapid; but it was for a time a good deal checked by the hostile irruptions of the Creek Indians, who continually harassed the frontiers of the state. This evil is now little known, and the recent

Georgia. recent annexation of Florida to the territories of the United States, is likely to secure Georgia from Indian warfare in future.

From the sea coast to the distance of more than 100 miles, the country is a level plain; the soil a sandy loam, and covered with pine, except in the morasses, and places occasionally inundated by the rivers, where it is rich, and favourable to the growth of most agricultural productions. Beyond this plain the surface rises into pleasant waving hills, which stretch backwards till they unite with the chain of Apalachian mountains. This undulating country is extremely rich and fertile.

The climate in general is somewhat warmer than that of South Carolina. The range of the thermometer in winter is from 40 to 60 Fahrenheit. From 1st June to 1st September it fluctuates from 76 to 90; but has been observed as high as 102°. The flat country is moist and unhealthy; but the upper parts are pleasant and salubrious.

The wild animals are still pretty numerous round the swamps, and on the high ridges, especially bears and deer. Alligators abound in the Alatamaha river, yet they are not dreaded, and have rarely attacked men, though they occasionally destroy animals. The magophex or gouffre, which inhabits a shell 15 inches long, burrows in the pine lands. It is able to move with a man on its back. Honey bees abound in the swamps, and musquitos are numerous during the heats of summer.

The population of Georgia in 1810 was 252,433, including 107,019 slaves, and 1801 free blacks. Savannah, the largest town, contained 7624 inhabitants in 1817. The population of the state in 1800 was 162,686, including 59,699 slaves, and 1919 free blacks; so that the slaves increased rather faster than the white inhabitants in the interval between these periods. The militia of Georgia in 1815 amounted to 27,480. The shipping of the state in the same year amounted to 15,287 tons; and the exports in 1817 amounted to 8,790,714 dollars. The chief articles of export are live stock, maize, rice, tobacco, cotton, indigo, flour, tar, naval stores, &c.

Cotton is more extensively cultivated in this than in any other state; and the species which grows along the coast, and is known by the name of *sea island*, is in high estimation. An acre yields about 600 pounds in the seed. Tobacco is also cultivated to a great extent; and within the last ten or fifteen years, sugar has been raised in considerable quantities. It grows along the coast, and about 120 miles inwards. An acre is said to yield from 2000 to 4000 pounds.

Savannah river forms a part of the divisional line which separates this state from South Carolina. It is formed principally of two branches, by the names of *Tugulo* and *Keowee*, which spring from the mountains. It is navigable for boats 140 miles. Ogeechee river, about 18 miles south of the Savannah, is a small river, and nearly parallel with it in its course. Alatamaha, about 90 miles south of Savannah river, is navigable as far as Darien. It is a noble river, but of difficult entrance. Like the Nile, it discharges itself by several mouths into the sea. Besides these, there is Turtle river, Crooked river, and St Mary's, which form a part of the southern boundary of the United States. The principal river in the middle and western parts of this state is the Apalachicola, which is formed by the Catahouchee and Flint rivers. It forms the western boundary of the state for 120 miles, and after a long southern course falls into the gulf of Mexico.

No general character will apply to the inhabitants at large. Collected from different parts of the world, as interest, necessity, or inclination led them, their character and manners must of course partake of all the varieties which distinguish the several states and kingdoms from whence they came. There is so little uniformity, that it is difficult to trace any governing principles among them. An aversion to labour is too predominant, owing in part to the relaxing heat of the climate, and partly to the want of necessity to excite industry. An open and friendly hospitality, particularly to strangers, is an ornamental characteristic of a great part of this people.

In regard to religion, politics, and literature, this state is yet in its infancy. In Savannah is an Episcopal church, a Presbyterian church, a synagogue, and a German Lutheran church, supplied occasionally by a German minister from Ebenezer, where there is a large convenient stone church, and a settlement of sober and industrious Germans of the Lutheran religion. In Augusta they have an Episcopal church. In Midway is a society of Christians established on the congregational plan. Their ancestors emigrated in a colony from Dorchester, near Boston, about the year 1700, and settled at a place named Dorchester, about 20 miles south-west of Charlestown, South Carolina. In 1752, for the sake of a better climate and more land, almost the whole society removed and settled at Midway.—They, as a people, retain in a great measure that simplicity of manners, that unaffected piety and brotherly love, which characterized their ancestors, the first settlers of New England. The upper countries are supplied pretty generally by Baptist and Methodist ministers; but the greater part of the state is without ministers of any denomination.

The numerous defects in the late constitution of this state, induced the citizens pretty universally to petition for a revision of it. It was accordingly revised, or rather a new one was formed, in the course of the year 1789, nearly upon the plan of the constitution of the United States, which has lately been adopted by the state.

The charter containing the present system of education in this state was passed in the year 1785. A college, with ample and liberal endowments, is instituted in Louisville, a high and healthy part of the country, near the centre of the state. There is also provision made for the institution of an academy in each county in the state, to be supported from the same funds, and considered as parts and members of the same institution, under the general superintendence and direction of a president and board of trustees, appointed for their literary accomplishments from the different parts of the state, and invested with the customary powers of corporations. The institution thus composed is denominated *the university of Georgia*.—The funds for the support of this institution are principally in lands, amounting in the whole to about 50,000 acres, a great part of which is of the best quality,

lity, and at present very valuable. There are also nearly 6000l. sterling in bonds, houses, and town lots in the town of Augusta. Other public property to the amount of 1000l. in each county has been set apart for the purposes of building and furnishing their respective academies. The funds originally designed for the support of the orphan house are chiefly in rice plantations and negroes.

GEORGIA, a township in the county of Franklin, containing about 400 inhabitants. It is situated on Lake Champlain, opposite to the north end of South Hero island.

GEORGIA, a cluster of barren islands in the South sea, to the eastward of the coast of Terra del Fuego, in lat. 54° 30′ S. and long. 37° W. One of these islands is 90 miles in length, and 30 in breadth.

GEORGIC, a poetical composition upon the subject of husbandry, containing rules therein, put into a pleasing dress, and set off with all the beauties and embellishments of poetry. The word is borrowed from the Latin *georgicus*, and that of the Greek γεωργικος, of γη, *terra*, "earth," and εργαζομαι, *opero*, "I work, or labour," of εργον, *opus*, "work." Hesiod and Virgil are the two greatest masters in this kind of poetry.—The moderns have produced nothing in this kind, except Rapin's book of Gardening; and the celebrated poem entitled Cyder, by Mr Philips, who, if he had enjoyed the advantage of Virgil's language, would have been second to Virgil in a much nearer degree.

GEORGIUM Sidus. See ASTRONOMY *Index*.

GEPIDÆ, GEPIDES, or GEPIDI, in *Ancient Geography*, according to Procopius, were a Gothic people, or a canton or branch of them; some of whom, in the migration of the Goths, settled in an island at the mouth of the Vistula, which they called *Gepidos* after their own name, which denotes lazy or slothful; others in Dacia, calling their settlement there *Gepidia*.

GERANIUM, CRANE'S BILL, in *Botany*, a genus of plants belonging to the monadelphia class; and in the natural method ranking under the 14th order, *Gruinales*. See BOTANY *Index*.

GERAR, or GERARA, in *Ancient Geography*, the south boundary of Canaan near Berseba; situated between Cades and Sur; two deserts well known, the former facing Egypt, the latter Arabia Petræa.

GERARDE, JOHN, a surgeon in London, and the greatest botanist of his time, was many years chief gardener to Lord Burleigh; who was himself a great lover of plants, and had the best collection of any nobleman in the kingdom, among which were a great number of exotics introduced by Gerarde. In 1597 he published his *Herbal*, which was printed at the expence of J. Norton, who procured from Francfort the same blocks in wood as were used in the herbal of Tabernæmontanus, In 1663, Thomas Johnson, an apothecary, published an improved edition of Gerarde's book; which met with such approbation by the university of Oxford, that they conferred on him the degree of doctor of physic. The descriptions in the herbal are plain and familiar; and both these authors have laboured more to make their readers understand the characters of the plants, than to inform them that they themselves understood Greek and Latin. The herbal of Gerarde is now to be considered only as a literary

curiosity. The figures in general express very accurately the characters of the plants they are intended to represent.

GERARDIA, a genus of plants belonging to the didynamia class, and in the natural method ranking under the 40th order, *Personatæ*. See BOTANY *Index*.

GERFALCON. See FALCO, ORNITHOLOGY *Index*.

GERGESA, in *Ancient Geography*, a Transjordan town, no otherwise known than by the *Gergeseni* of St Matthew, and *Gergesæi* of Moses; supposed to have stood in the neighbourhood of Gadara and near the sea of Tiberias. The *Gergesæi*, one of the seven ancient people of Canaan, less frequently mentioned than the rest, appear to have been less considerable and more obscure: their name is from *Girgasi*, one of Canaan's sons. See GIRGASHITES.

GERIZIM. See GARIZIM.

GERM, in vegetation. See GERMEN.

GERMAN, in matters of genealogy, signifies whole, entire, or own. *Germani, quasi eadem stirpe geniti*; (Fest.). Hence,

Brother GERMAN, denotes a brother both by the father's and mother's side, in contradistinction to uterine brothers, &c. who are only so by the mother's side.

Cousins GERMAN, are those in the first or nearest degree, being the children of brothers or sisters.

Among the Romans we have no instance of marriage between cousins german before the time of the emperor Claudius, when they were very frequent.

Theodosius prohibited them under very severe penalties, even fine and proscription. See CONSANGUINITY.

GERMAN, or *Germanic*, also denotes any thing belonging to Germany; as the German empire, German flute, &c.

GERMANDER. See TEUCRIUM, BOTANY *Index*.

GERMANICUS CÆSAR, the son of Drusus, and paternal nephew to the emperor Tiberius, who adopted him; a renowned general, but still more illustrious for his virtues. He took the title of *Germanicus* from his conquests in that country; and though he had the moderation to refuse the empire offered to him by his army, Tiberius, jealous of his success, and of the universal esteem he acquired, caused him to be poisoned, A. D. 29, aged 34. He was a protector of learning; and composed some Greek comedies and Latin poems, some of which are still extant.

GERMANTOWN, in the county of Philadelphia, Pennsylvania, in North America, about seven miles from the city of Philadelphia. It was once esteemed the second town in the country, till many inland towns in a short time rose superior to it, both for the extent of their establishments and number of inhabitants. The knitting of cotton, thread, and worsted stockings, is carried on in it to a considerable extent. The principal congregation of the people called Mennonists is in Germantown, who derive their name from one Menno Simon, a learned man of Witmars in Germany. Although inimical to the doctrine of general salvation, they will not swear, fight, bear any civil office, go to law, or take interest for money. Germantown is also memorable for a bloody battle which was fought in it on the 4th of October, 1777.

GERMANY.

GERMANY, a very extensive empire of Europe, but which, in different ages of the world, has had very different limits. Its name, according to the most probable conjecture, is derived from the Celtic words *Ghar man*, signifying a warlike man, to which their other name, *Allman*, or *Aleman*, likewise alludes.

The ancient history of the Germans is altogether wrapped up in obscurity. The first time we find them mentioned by the Roman historians, is about the year 211 B. C. at which time Marcellus subdued Insubria and Liguria, and defeated the Gæsatæ, a German nation situated on the banks of the Rhine. From this time history is silent with regard to any of these northern nations, till the irruption of the Cimbri and Teutones, who inhabited the most northerly parts of Germany.

1 Limits of ancient Germany.

It is very difficult to fix the limits of the country called *Germany* by the Romans. The southern Germans were intermixed with the Gauls, and the northern ones with the Scythians; and thus the ancient history of the Germans includes that of the Dacians, Huns, Goths, &c. till the destruction of the western Roman empire by them. Ancient Germany, therefore, we may reckon to have included the northern part of France, the Netherlands, Holland, *Germany* so called at present, Denmark, Prussia, Poland, Hungary, part of Turkey in Europe, and Muscovy.

The Romans divided Germany into two regions; Belgic or Lower Germany, which lay to the southward of the Rhine; and Germany Proper, or High Germany.

2 Nations inhabiting Lower Germany.

The first lay between the rivers Seine and the Rhine; and in this we find a number of different nations, the most remarkable of which were the following.

1. The Ubii, whose territory lay between the Rhine and the Mosa or Maese, and whose capital was the city of Cologne. 2. Next to them were the Tungri, supposed to be the same whom Cæsar calls *Eburones* and *Condrusi;* and whose metropolis, then called *Attuatica*, has since been named *Tongres*. 3. Higher up from them, and on the other side of the Moselle, were the Treviri, whose capital was Augusta Trevirorum, now *Triers*. 4. Next to them were the Tribocci, Nemetes, and Vangiones. The former dwelt in Alsace, and had Argentoratum, now *Strasburg*, for their capital; the others inhabited the cities of Worms, Spire, and Mentz. 5. The Mediomatrici were situated along the Moselle, about the city of Metz in Lorrain: and above them were situated another German nation, named *Raurici*, *Rauraci*, or *Rauriaci*, and who inhabited that part of Helvetia, or Switzerland, about Basil. To the westward and southward of these were the Nervii, Suessiones, Silvanectes, Leuci, Rhemi, Lingones, &c. who inhabited Belgic Gaul.

Between the heads of the Rhine and Danube was seated the ancient kingdom of Vindelicia, whose capital was called *Augusta Vindelicorum*, now *Augsburg*. Below it on the banks of the Danube were the kingdoms of Noricum and Pannonia. The first of these was divided into Noricum *Ripense* and *Mediterraneum*. It contained a great part of the provinces of Austria, Stiria, Carinthia, Tyrol, Bavaria, and some others of less note. The latter contained the kingdom of Hungary, divided into Upper and Lower; and extended from Illyricum to the Danube, and the mountains Cætii in the neighbourhood of *Vindebona*, now *Vienna*.

Upper or High Germany lay beyond the Rhine and the Danube. 3 Nations inhabiting High Germany.

Between the Rhine and the Elbe were the following nations. 1. The Chauci, Upper and Lower; who were divided from each other by the river Visurges, now the *Weser*. Their country contained what is now called *Bremen*, *Lunenburg*, *Friezland*, and *Groninghen*. The Upper Chauci had the Cherusci, and the lower the Chamavi on the south-east, and the German ocean on the north-west. 2. The Frisii, Upper and Lower, were divided from the Lower Chauci by the river Amisia, now the Ems; and from one another by an arm of the Rhine. Their country still retains the name of *Friesland*, and is divided into east and west; but the latter is now dismembered from Germany, and become one of the Seven United Provinces. 3. Beyond the Isela, now the *Isel*, which bounded the country of the Frisi, were situated the Bructeri, who inhabited the tract now called *Broecmorland;* and the Marsi, about the river Luppe. On the other side of that river were the *Usipii* or *Usipetes;* but these were famed for often changing their territories, and therefore found in other places. 4. Next to these were the Juones, or inhabitants of Juliers, between the Maese and the Rhine. 5. The Catti, another ancient and warlike nation, inhabited Hesse and Thuringia, from the Hartzian mountains to the Rhine and Weser: among whom were comprehended the Mattiaci, whose capital is by some thought to be *Marpurg*, by others *Baden*. 6. Next to these were the Sedusii bordering upon Suabia; the Norisci, or the ancient inhabitants of Northgow, whose capital was Nuremberg; and the Marcomanni, whose country anciently reached from the Rhine to the head of the Danube, and to the Neckar. The Marcomanni afterwards went and settled in Bohemia and Moravia, under their general or king Maroboduus: and some of them in Gaul, whence they drove the Boii, who had seated themselves there. 7. On the other side of the Danube, and between the Rhine and it, were the Hermunduri, who possessed the country now called *Misnia* in Upper Saxony; though some make their territories to have extended much farther, and to have reached quite to, or even beyond, the kingdom of Bohemia, once the seat of the Boii, whence its name. 8. Beyond them, on the north of the Danube, was another seat of the Marcomanni along the river Albis, or Elbe. 9. Next to Bohemia were situated the Quadi, whose territories extended from the Danube to Moravia, and the northern part of Austria. These are comprehended under the ancient name of *Suevi;* part of whom at length forced their way into Spain, and settled a kingdom there. 10. Eastward of the Quadi were situated the Bastarnæ, and parted from them by the Granna, now *Gran;* a river that falls into the Danube, and by the Carpathian mountains, from them called *Alpes Bastarnicæ*. The country of the Bastarnæ indeed

indeed made part of the European Sarmatia, and so was without the limits of Germany properly so called; but we find these people so often in league with the German nations, and joining them for the destruction of the Romans, that we cannot but account them as one people.

Between those nations already taken notice of, seated also on the other side of the Danube and the Hercynian forest, were several others whose exact situation is uncertain, viz. the Martingi, Burii, Borades, Lygii or Logiones, and some others, who are placed by our geographers along the forest above mentioned, between the Danube and the Vistula.

On this side the Hercynian forest, were the famed Rhætii, now *Grisons*, seated among the Alps. Their country, which was also called *Western Illyricum*, was divided into Rhætia *Prima* or *Propria* and *Secunda*; and was then of much larger extent, spreading itself towards Suabia, Bavaria, and Austria.

On the other side of the Hercynian forest were, 1. The Suevi, who spread themselves from the Vistula to the river Elbe. 2. The Longobardi, so called according to some on account of their wearing long beards, but, according to others, on account of their consisting of two nations, viz. the Bardi and Lingones. These dwelt along the river Elbe, and bordered southward on the Chauci above mentioned. 3. The Burgundi, of whose original seat we are uncertain. 4. The Semnones; who, about the time of Tiberius, were seated on the river Elbe. 5. The Angles, Saxons, and Goths, were probably the descendants of the Cimbri; and inhabited the countries of Denmark, along the Baltic sea, and the peninsula of Scandinavia, containing Norway, Sweden, Lapland, and Finmark. 6. The Vandals were a Gothic nation, who, proceeding from Scandinavia, settled in the countries now called *Mecklenburgh* and *Brandenburgh*. 7. Of the same race were the Dacians, who settled themselves in the neighbourhood of the Palus Mæotis, and extended their territories along the banks of the Danube.

4
W[illegible] of the Scordisci with the Romans.

These were the names of the German nations who performed the most remarkable exploits in their wars with the Romans. Besides these, however, we find mention made of the Scordisci, a Thracian nation, who afterwards settled on the banks of the Danube. About the year 113 B. C. they ravaged Macedon, and cut off a whole Roman army sent against them; the general, M. Porcius Cato, grandson to Cato the censor, being the only person who had the good fortune to make his escape. After this, they ravaged all Thessaly; and advanced to the coasts of the Adriatic, into which, because it stopped their farther progress, they discharged a shower of darts. By another Roman general, however, they were driven back into their own country with great slaughter; and soon after, Metellus so weakened them by repeated defeats, that they were incapable, for some time, of making any more attempts on the Roman provinces. At last, in the consulship of M. Livius Drusus and L. Calpurnius Piso, the former prevailed on them to pass the Danube, which thenceforth became the boundary between the Romans and them. Notwithstanding this, in the time of the Jugurthine war, the Scordisci repassed the Danube on the ice every winter, and being joined by the Triballi a people of Lower Mæsia, and the Daci of Upper Mæsia, penetrated as far as Macedon, committing everywhere dreadful ravages. So early did these northern nations begin to be formidable to the Romans, even when they were most renowned for warlike exploits.

5
Expedition of Julius Cæsar into Germany.

Till the time of Julius Cæsar, however, we hear nothing more concerning the Germans. About 58 years B. C. he undertook his expedition into Gaul; during which, his assistance was implored by the Ædui, against Ariovistus, a German prince who oppressed them. Cæsar, pleased with this opportunity of increasing his power, invited Ariovistus to an interview; but this being declined, he next sent deputies, desiring him to restore the hostages he had taken from the Ædui, and to bring no more troops over the Rhine into Gaul. To this a haughty answer was returned; and a battle soon after ensued, in which Ariovistus was entirely defeated, and with great difficulty made his escape.

In 55 B. C. Cæsar having subdued the Suessiones, Bellovaci, Ambiani, Nervii, and other nations of Belgic Gaul, hastened to oppose the Usipetes and Tenchtheri. These nations having been driven out of their own country by the Suevi, had crossed the Rhine with a design to settle in Gaul. As soon as he appeared, the Germans sent him a deputation, offering to join him, provided he would assign them lands. Cæsar replied, that there was no room in Gaul for them; but he would desire the Ubii to give them leave to settle among them. Upon this, they desired him to retreat with the Ubii; but in the mean time fell upon some Roman squadrons: which so provoked Cæsar, that he immediately marched against them, and coming unexpectedly upon them, defeated them, with great slaughter. They fled in the utmost confusion; but the Romans pursued them to the conflux of the Rhine and the Maese, where the slaughter was renewed with such fury, that almost 400,000 of the Germans perished. After this, Cæsar being resolved to spread the terror of the Roman name through Germany, built a bridge over the Rhine, and entered that country. In this expedition, however, which was his last in Germany, he performed no remarkable exploit. A little before his death, indeed, he had projected the conquest of that, as well as of a great many other countries; but his assassination prevented the execution of his designs. Nor is there any thing recorded of the Germans till about 17 B. C. when the Tenchtheri made an irruption into Gaul, and defeated M. Lollius, proconsul of that province. At last, however, they were repulsed, and forced to retire with great loss beyond the Rhine.

6
Rhætii invade Italy.

Soon after this the Rhætii invaded Italy, where they committed the greatest devastations, putting all the males they met to the sword, without distinction of age: nay, we are told, that when they happened to take women with child, they consulted their augurs to know whether the child was a male or female; and if they pronounced it a male, the mother was immediately massacred. Against these barbarians was sent Drusus, the second son of Livia, a youth of extraordinary valour and great accomplishments. He found means to bring them to a battle; in which the Romans proved victorious, and cut in pieces great numbers of their enemies, with very little loss on their own

own side. Those who escaped the general slaughter, being joined by the Vindelici, took their route towards Gaul, with a design to invade that province. But Augustus, upon the first notice of their march, despatched against them Tiberius with several chosen legions. He was no less successful than Drusus had been; for having transported his troops over the lake Brigantium, now Constance, he fell unexpectedly on the enemy, gave them a total overthrow, took most of their strong holds, and obliged the whole nation to submit to such terms as he chose to impose upon them.

7 They are subdued, together with the Vindelici and Norici.

Thus were the Vindelici, the Rhætii, and Norici, three of the most barbarous nations in Germany subdued. Tiberius, to keep the conquered countries in awe, planted two colonies in Vindelicia, and opened from thence a road into Rhætia and Noricum. One of the cities which he built for the defence of his colonies, he called, from his father Drusus, *Drusomagus*; the other by the name of Augustus, *Augusta Vindelicorum*; which cities are now known by the names of *Mimminghen* and *Augsburg*. He next encountered the Pannonians, who had been subdued by Agrippa, but revolted on hearing the news of that great commander's death, which happened 11 years B. C. Tiberius, however, with the assistance of their neighbours the Scordisci, soon forced them to submit. They delivered up their arms, gave hostages, and put the Romans in possession of all their towns and strong holds. Tiberius spared their lives; but laid waste their fields, plundered their cities, and sent the best part of their youth into other conntries.

8 and the Pannonians.

In the mean time, Drusus having prevented the Gauls from revolting, which they were ready to do, prepared to oppose the Germans who dwelt beyond the Rhine. They had collected the most numerous and formidable army that had ever been seen in those parts; with which they were advancing towards the Rhine, in order to invade Gaul. Drusus defeated them as they attempted to cross that river; and, pursuing the advantage he had gained, entered the country of the Usipetes, now *Relinchusen*, and from thence advanced against the Sicambri in the neighbourhood of the Lyppe and Yssel. Them he overthrew in a great battle, laid waste their country, burnt most of their cities, and following the course of the Rhine, approached the German ocean, reducing the Frisii and the Chauci between the Ems and the Elbe. In these marches the troops suffered extremely for want of provisions; and Drusus himself was often in great danger of being drowned, as the Romans who attended him were at that time quite unacquainted with the flux and reflux of the ocean.

9 Exploits of Drusus in Germany.

The Roman forces went into East Friesland for their winter quarters; and next year (10 B. C.) Drusus marched against the Tenchtheri, whom he easily subdued. Afterwards, passing the Lupias, now the Lyppe, he reduced the Catti and Cherusci, extending his conquests to the banks of the Visurgis or Weser; which he would have passed, had he not been in want of provisions, the enemy having laid waste the country to a considerable distance. As he was retiring, the Germans unexpectedly fell upon him in a narrow passage; and having surrounded the Roman army, cut a great many of them in pieces. But Drusus having animated his men by his example, after a bloody conflict, which lasted the whole day, the Germans were defeated with such slaughter, that the ground was strewed for several miles with dead bodies. Drusus found in their camp a great quantity of iron chains which they had brought for the Romans; and so great was their confidence, that they had agreed beforehand about the division of the booty. The Tenchtheri were to have the horses, the Cherusci and Sicambri the baggage, and the Usipetes and Catti the captives. After this victory, Drusus built two forts to keep the conquered countries in awe; the one at the confluence of the Lyppe and the Alme, the other in the country of the Catti on the Rhine. On this occasion also he made a famous canal, long after called in honour of him *Fossa Drusiana*, to convey the waters of the Rhine into the Sala or Sale. It extended eight miles; and was very convenient for conveying the Roman troops by water to the countries of the Frisii and Chauci, which was the design of the undertaking.

The following year (9 B. C.) Augustus, bent on subduing the whole of Germany, advanced to the banks of the Rhine, attended by his two sons-in-law Tiberius and Drusus. The former he sent against the Daci, who lived up to the south of the Danube; and the latter to complete the conquest he had so successfully begun in the western parts of Germany. The former easily overcame the Daci, and transplanted 40,000 of them into Gaul. The latter, having passed the Rhine, subdued all the nations from that river to the Elbe; but having attempted in vain to cross this last, he set out for Rome: an end, however, was put to his conquests and his life by a violent fever, with which he was seized on his return.

After the death of Drusus, Tiberius again overran all those countries in which Drusus had spent the preceding summer; and struck some of the northern nations with such terror, that they sent deputies to sue for peace. This, however, they could not obtain upon any terms; the emperor declaring that he would not conclude a peace with one, unless they all desired it. But the Catti, or according to some the Sicambri, could not by any means be prevailed upon to submit; so that the war was still carried on, though in a languid manner, for about 18 years. During this period, some of the German nations had quitted their forests, and begun to live in a civilized manner under the protection of the Romans; but one Quinctilius Varus being sent to command the Roman forces in that country, so provoked the inhabitants by his extortions, that not only those who still held out refused to submit, but even the nations that had submitted were seized with an eager desire of throwing off the yoke. Among them was a young nobleman of extraordinary parts and valour, named *Arminius*. He was the son of Sigimer, one of the most powerful lords among the Catti, had served with great reputation in the Roman armies, and been honoured by Augustus with the privileges of a Roman citizen and the title of knight. But the love of his country prevailing over his gratitude, he resolved to improve the general discontent which reigned among his countrymen, to deliver them from the bondage of a foreign dominion. With this view he engaged, underhand, the leading men of all the nations between the Rhine and the Elbe, in a conspiracy against the Romans. In order to put Varus off

10 Arminius heads the Germans against the Romans.

off his guard, he at the same time advised him to show himself to the inhabitants of the more distant provinces, administer justice among them, and accustom them, by his example, to live after the Roman manner, which he said would more effectually subdue them than the Roman sword. As Varus was a man of a peaceable temper, and averse from military toils, he readily consented to this insidious proposal, and, leaving the neighbourhood of the Rhine, marched into the country of the Cherusci. Having there spent some time in hearing causes and deciding civil controversies, Arminius persuaded him to weaken his army, by sending out detachments to clear the country of robbers. When this was done, some distant nations of Germany rose up in arms by Arminius's directions; while those through which Varus was to pass in marching against them, pretended to be in a state of profound tranquillity, and ready to join the Romans against their enemies.

11
...s off ...rus with army.

On the first news of the revolt, Varus marched against the enemy with three legions and six cohorts; but being attacked by the Germans as he passed through a wood, his army was almost totally cut off, while he himself and most of his officers fell by their own hands. Such a terrible overthrow, though it raised a general consternation in Rome, did not, however, dishearten Augustus, or cause him to abandon his enterprise. About two years after (A. D. 12.), Tiberius and Germanicus were appointed to command in Germany. The death of Augustus, however, which happened soon after, prevented Tiberius from going on his expedition; and Germanicus was for some time hindered from proceeding in his, by a revolt of the legions, first in Pannonia, and then in Germany. About the year 15, Germanicus having brought over the soldiers to their duty, laid a bridge across the Rhine, over which he marched 12,000 legionaries, 26 cohorts of the allies, and eight alæ (squadrons of 300 each) of horse. With these he first traversed the Cœsian forest (part of the Hercynian, and thought to lie partly in the duchy of Cleves, and partly in Westphalia), and some other woods. On his march he was informed that the Marsi were celebrating a festival with great mirth and jollity. Upon this he advanced with such expedition, that he surprised them in the midst of their debauch; and giving his army full liberty to make what havock they pleased, a terrible massacre ensued, and the country was destroyed with fire and sword for 50 miles round, without the loss of a single man on the part of the Romans.—This general massacre roused the Bructeri, the Tubantes, and the Usipetes; who, besetting the passes through which the Roman army was to return, fell upon their rear, and put them into some disorder; but the Romans soon recovered themselves, and defeated the Germans with considerable loss.

12
...loits of ...mani...

The following year (A. D. 16), Germanicus taking advantage of some intestine broils which happened among the Catti, entered their country, where he put great numbers to the sword. Most of their youth, however, escaped by swimming over the Adrana, now the Oder, and attempted to prevent the Romans from laying a bridge over that river: but being disappointed in this, some of them submitted to Germanicus, while the greater part, abandoning their villages, took refuge in the woods; so that the Romans, without opposition, set fire to all their villages, towns, &c. and having laid their capital in ashes, began their march back to the Rhine.

Germanicus had scarce reached his camp, when he received a message from Segestes, a German prince, in the interest of the Romans, acquainting him that he was besieged in his camp by Arminius. On this advice, he instantly marched against the besiegers; entirely defeated them; and took a great number of prisoners, among whom was Thusneldis, the wife of Arminius, and daughter of Segestes, whom the former had carried off, and married against her father's will. Arminius then, more enraged than ever, for the loss of his wife, whom he tenderly loved, stirred up all the neighbouring nations against the Romans. Germanicus, however, without being dismayed by such a formidable confederacy, prepared himself to oppose the enemy with vigour: but, that he might not be obliged to engage such numerous forces at once, detached his lieutenant Cæcina, at the head of 40 cohorts, into the territories of the Bructeri; while his cavalry, under the command of Pedo, entered the country of the Frisii. As for Germanicus himself, he embarked the remainder of his army, consisting of four legions, on a neighbouring lake; and transported them by rivers and canals to the place appointed on the river Ems, where the three bodies met. In their march they found the sad remains of the legions conducted by Varus, which they buried with all the ceremony their circumstances could admit. After this they advanced against Arminius, who retired and posted himself advantageously close to a wood. The Roman general followed him; and coming up with him, ordered his cavalry to advance and attack the enemy. Arminius, at their first approach, pretended to fly but suddenly wheeled about, and giving the signal to a body of troops, whom he had concealed in the wood, to rush out, obliged the cavalry to give ground. The cohorts then advanced to their relief; but they too were put into disorder, and would have been pushed into a morass, had not Germanicus himself advanced with the rest of the cavalry to their relief. Arminius did not think it prudent to engage these fresh troops, but retired in good order; upon which Germanicus also retired towards the Ems. Here he embarked with four legions, ordered Cæcina to reconduct the other four by land, and sent the cavalry to the sea side, with orders to march along the shore to the Rhine. Though Cæcina was to return by roads well known, yet Germanicus advised him to pass, with all possible speed, a causeway, called the *long bridges*, which led across vast marshes, surrounded on all sides with woods and hills that gently rose from the plain.

Arminius, however, having got notice of Cæcina's march, arrived at the long bridges before Cæcina, and filled the woods with his men, who, on the approach of the Romans, rushed out, and attacked them with great fury. The legions, not able to manage their arms in the deep waters and slippery ground, were obliged to yield: and would in all probability have been entirely defeated, had not night put an end to the combat. The Germans, encouraged by their successes, instead of refreshing themselves with sleep, spent the whole night in diverting the courses of the springs which

Germany. which rose in the neighbouring mountains; so that, before day, the camp which the Romans had begun was laid under water, and their works were overturned. Cæcina was for some time at a loss what to do; but at last resolved to attack the enemy by daybreak, and, having driven them to their woods, to keep them there in a manner besieged, till the baggage and wounded men should pass the causeway, and get out of the enemy's reach. But when his army was drawn up, the legions posted on the wings, seized with a sudden panic, deserted their stations, and occupied a field beyond the marshes. Cæcina thought it advisable to follow them; but the baggage stuck in the mire, as he attempted to cross the marshes, which greatly embarrassed the soldiers. Arminius perceiving this, laid hold of the opportunity to begin the attack; and crying out, "This is a second Varus, the same fate attends him and his legions," fell on the Romans with inexpressible fury. As he had ordered his men to aim chiefly at the horses, great numbers of them were killed; and the ground becoming slippery with their blood and the slime of the marsh, the rest either fell or threw their riders, and, galloping through the ranks, put them in disorder. Cæcina distinguished himself in a very eminent manner; but his horse being killed, he would have been taken prisoner, had not the first legion rescued him. The greediness of the enemy, however, saved the Romans from utter destruction; for just as the legions were quite spent, and on the point of yielding, the barbarians on a sudden abandoned them in order to seize their baggage. During this respite, the Romans struggled out of the marsh, and having gained the dry fields, formed a camp with all possible speed, and fortified it in the best manner they could.

The Germans having lost the opportunity of destroying the Romans, contrary to the advice of Arminius, attacked their camp next morning, but were repulsed with great slaughter; after which they gave Cæcina no more molestation till he reached the banks of the Rhine. Germanicus, in the mean time, having conveyed the legions he had with him down the river Ems into the ocean, in order to return by sea to the river Rhine, and finding that his vessels were overloaded, delivered the second and 14th legions to Publius Vitellius, desiring him to conduct them by land. But this march proved fatal to great numbers of them; who were either buried in the quicksands, or swallowed up by the overflowing of the tide, to which they were as yet utter strangers. Those who escaped, lost their arms, utensils, and provisions; and passed a melancholy night upon an eminence, which they had gained by wading up to the chin. The next morning the land returned with the tide of ebb; when Vitellius, by a hasty march, reached the river Usingis, by some thought to be the Hoerenster, on which the city of Groningen stands. There Germanicus, who had reached that river with his fleet, took the legions again on board, and conveyed them to the mouth of the Rhine, whence they all returned to Cologne, at a time when it was reported they were totally lost.

This expedition, however, cost the Romans very dear, and procured very few advantages. Great numbers of men had perished; and by far the greatest part of those who had escaped so many dangers returned without arms, utensils, horses, &c. half naked, lamed, and unfit for service. The next year, however, Germanicus, bent on the entire reduction of Germany, made vast preparations for another expedition. Having considered the various accidents, that had befallen him during the war, he found that the Germans were chiefly indebted for their safety to their woods and marshes, their short summers and long winters; and that his troops suffered more from their long and tedious marches than from the enemy. For this reason he resolved to enter the country by sea, hoping by that means to begin the campaign earlier, and surprise the enemy. Having therefore built with great despatch, during the winter, 1000 vessels of different sorts, he ordered them early in the spring (A. D. 16.) to fall down the Rhine, and appointed the island of the Batavians for the general rendezvous of his forces. When the fleet was sailing, he detached Silius, one of his lieutenants, with orders to make a sudden irruption into the country of the Catti; and, in the mean time, he himself, upon receiving intelligence that a Roman fort on the Luppias was besieged, hastened with six legions to its relief. Silius was prevented, by sudden rains, from doing more than taking some small booty, with the wife and daughter of Arpen, king of the Catti; neither did those who besieged the fort wait the arrival of Germanicus. In the mean time, the fleet arriving at the island of the Batavians, the provisions and warlike engines were put on board and sent forward; ships were assigned to the legions and allies; and the whole army being embarked, the fleet entered the canal formerly cut by Drusus, and from his name called *Fossa Drusiana*. Hence he sailed prosperously to the mouth of the Ems; where, having landed his troops, he marched directly to the Weser, where he found Arminius encamped on the opposite bank, and determined to dispute his passage. The next day Arminius drew out his troops in order of battle; but Germanicus, not thinking it advisable to attack them, ordered the horse to ford over under the command of his lieutenants Stertinius and Emilius; who, to divide the enemy's forces, crossed the river in two different places. At the same time Cariovalda, the leader of the Batavian auxiliaries, crossed the river where it is most rapid; but being drawn into an ambuscade, he was killed, together with most of the Batavian nobility; and the rest would have been totally cut off, had not Stertinius and Emilius hastened to their assistance. Germanicus in the mean time passed the river without molestation. A battle soon after ensued, in which the Germans were defeated with so great a slaughter, that the ground was covered with arms and dead bodies for more than 10 miles round; and among the spoils taken on this ocasion, were found, as formerly, the chains with which the Germans had hoped to bind their captives.

13 His second expedition.

In memory of this signal victory Germanicus raised a mount, upon which he placed as trophies the arms of the enemy, and inscribed underneath the names of the conquered nations. This so provoked the Germans, though already vanquished and determined to abandon their country, that they attacked the Roman army unexpectedly on its march, and put them into some disorder. Being repulsed, they encamped between a river and a large forest surrounded by a marsh except on on one side, where it was enclosed by a broad rampart formerly raised by the Angrivarii as a barrier between them and the Cherusci. Here another battle ensued; in which the Germans behaved with great bravery, but in the end were defeated with great slaughter.

After this second defeat, the Angrivarii submitted, and were taken under the protection of the Romans, and Germanicus put an end to the campaign. Some of the legions he sent to their winter quarters by land, while he himself embarked with the rest on the river Ems, in order to return by sea. The ocean proved at first very calm, and the wind favourable; but all of a sudden a storm arising, the fleet consisting of 1000 vessels, was dispersed: some of them were swallowed up by the waves; others were dashed in pieces against the rocks, or driven upon remote and inhospitable islands, where the men either perished by famine, or lived upon the flesh of the dead horses with which the shores soon appeared strewed; for, in order to lighten their vessels, and disengage them from the shoals, they had been obliged to throw overboard their horses and beasts of burden, nay, even their arms and baggage. Most of the men, however, were saved, and even great part of the fleet recovered. Some of them were driven upon the coast of Britain; but the petty kings who reigned there generously sent them back.

14 His fleet dispersed by a storm.

On the news of this misfortune, the Catti, taking new courage, ran to arms; but Caius Silius being detached against them with 30,000 foot and 3000 horse, kept them in awe. Germanicus himself, at the head of a numerous body, made a sudden irruption into the territories of the Marsi, where he recovered one of Varus's eagles, and having laid waste the country, he returned to the frontiers of Germany, and put his troops into winter quarters: whence he was soon recalled by Tiberius, and never suffered to return into Germany again.

After the departure of Germanicus, the more northern nations of Germany were no more molested by the Romans. Arminius carried on a long and successful war with Maroboduus king of the Marcomanni, whom he at last expelled, and forced to apply to the Romans for assistance; but, excepting Germanicus, it seems they had at this time no other general capable of opposing Arminius, so that Maroboduus was never restored. After the final departure of the Romans, however, Arminius having attempted to enslave his country, fell by the treachery of his own kindred. The Germans held his memory in great veneration; and Tacitus informs us, that in his time they still celebrated him in their songs.

15 Death of Arminius.

Nothing remarkable occurs in the history of Germany from this time till the reign of the emperor Claudius. A war indeed is said to have been carried on by Lucius Domitius, father to the emperor Nero. But of his exploits we know nothing more than that he penetrated beyond the river Elbe, and led his army farther into the country than any of the Romans had ever done. In the reign of Claudius, however, the German territories were invaded by Cn. Domitius Corbulo, one of the greatest generals of his age. But when he was on the point of forcing them to submit to the Roman yoke, he was recalled by Claudius, who was jealous of the reputation he had acquired.

In the reign of Vespasian, a terrible revolt happened among the Batavians and those German nations who had submitted to the Romans; a particular account of which is given under the article ROME. The revolters were with difficulty subdued; but, in the reign of Domitian, the Dacians invaded the empire, and proved a more terrible enemy than any of the other German nations had been. After several defeats, the emperor was at last obliged to consent to pay an annual tribute to Decebalus king of the Dacians; which continued to the time of Trajan. But that warlike prince refused to pay tribute; alleging, when it was demanded of him, that "he had never been conquered by Decebalus." Upon this the Dacians passed the Danube, and began to commit hostilities in the Roman territories. Trajan, glad of this opportunity to humble an enemy whom he began to fear, drew together a mighty army, and marched with the utmost expedition to the banks of the Danube. As Decebalus was not apprised of his arrival, the emperor passed the river without opposition, and entering Dacia, laid waste the country with fire and sword. At last he was met by Decebalus with a numerous army. A bloody engagement ensued, in which the Dacians were defeated; though the victory cost the Romans dear: the wounded were so numerous, that they wanted linen to bind up their wounds; and to supply the defect, the emperor generously devoted his own wardrobe. After the victory, he pursued Decebalus from place to place, and at last obliged him to consent to a peace on the following terms: 1. That he should surrender the territories which he had unjustly taken from the neighbouring nations. 2. That he should deliver up his arms, his warlike engines, with the artificers who made them, and all the Roman deserters. 3. That for the future he should entertain no deserters, nor take into his service the natives of any country subject to Rome. 4. That he should dismantle all his fortresses, castles, and strong holds. And, lastly, That he should have the same friends and foes with the people of Rome.

16 The Dacians invade the Roman empire.

With these hard terms Decebalus was obliged to comply, though sore against his will; and being introduced to Trajan, threw himself on the ground before him, acknowledging himself his vassal; after which the latter, having commanded him to send deputies to the senate for the ratification of the peace, returned to Rome.

This peace was of no long duration. Four years after (A. D. 105.), Decebalus, unable to live in servitude as he called it, began, contrary to the late treaty, to raise men, provide arms, entertain deserters, fortify his castles, and invite the neighbouring nations to join him against the Romans as a common enemy. The Scythians hearkened to his solicitations; but the Jazyges, a neighbouring nation, refusing to bear arms against Rome, Decebalus invaded their country. Hereupon Trajan marched against him; but the Dacian, finding himself unable to withstand him by open force, had recourse to treachery, and attempted to get the emperor murdered. His design, however, proved abortive, and Trajan pursued his march into Dacia. That his troops might the more readily pass and repass the Danube, he built a bridge over that river; which by the ancients is styled the most magnificent and wonderful of all his works*. To guard the bridge, he

* See *Architecture*, N° 133.

he ordered two castles to be built; one on this side the Danube, and the other on the opposite side; and all this was accomplished in the space of one summer. Trajan, however, as the season was now far advanced, did not think it adviseable to enter Dacia this year, but contented himself with making the necessary preparations.

17
They are subdued by Trajan.

In the year 106, early in the spring, Trajan set out for Dacia; and having passed the Danube on the bridge he had built, reduced the whole country, and would have taken Decebalus himself, had he not put an end to his own life, in order to avoid falling into the hands of his enemies. After his death the kingdom of Dacia was reduced to a Roman province; and several castles were built in it, and garrisons placed in them, to keep the country in awe.

18
Marcomanni and Quadi formidable to the empire.

After the death of Trajan, the Roman empire began to decline, and the northern nations to be daily more and more formidable. The province of Dacia indeed was held by the Romans till the reign of Gallienus; but Adrian, who succeeded Trajan, caused the arches of the bridge over the Danube to be broken down, lest the barbarians should make themselves masters of it, and invade the Roman territories. In the time of Marcus Aurelius, the Marcomanni and Quadi invaded the empire, and gave the emperor a terrible overthrow. He continued the war, however, with better success afterwards, and invaded their country in his turn. It was during the course of this war that the Roman army is said to have been saved from destruction by that miraculous event related under the article CHRISTIANS, p. 70. col. 2.

In the end, the Marcomanni and Quadi were, by repeated defeats, brought to the verge of destruction, insomuch that their country would probably have been reduced to a Roman province, had not Marcus Aurelius been diverted from pursuing his conquests by the revolt of one of his generals. After the death of Marcus Aurelius, the Germanic nations became every day more and more formidable to the Romans. Far from being able to invade and attempt the conquest of these northern countries, the Romans had the greatest difficulty to repress the incursions of their inhabitants. But for a particular account of their various invasions of the Roman empire, and its total destruction by them at last, see the article ROME.

19
Roman empire destroyed by the Heruli.

The immediate destroyers of the Roman empire were the Heruli; who, under their leader Odoacer, dethroned Augustulus the last Roman emperor, and proclaimed Odoacer king of Italy. The Heruli were soon expelled by the Ostrogoths; and these in their turn were subdued by Justinian, who annexed Italy to the eastern empire. But the popes found means to obtain the temporal as well as spiritual jurisdiction over a considerable part of the country, while the Lombards subdued the rest. These last proved very troublesome to the popes, and at length besieged Adrian I. in his capital. In this distress he applied to Charles the Great, king of France; who conquered both Italy and Germany, and was crowned emperor of the west in 800.

20
History of Germany since the time of Charlemagne.

The posterity of Charlemagne inherited the empire of Germany until the year 880; at which time the different princes assumed their original independence, rejected the Carlovingian line, and placed Arnulph king of Bohemia on the throne. Since this time Germany has ever been considered as an elective monarchy. Princes of different families, according to the prevalence of their interest and arms, have mounted the throne. Of these the most considerable, until the Austrian line acquired the imperial power were the houses of Saxony, Franconia, and Suabia. The reigns of these emperors contain nothing more remarkable than the contests between them and the popes; for an account of which see the article ITALY. From hence, in the beginning of the 13th century, arose the factions of the Guelphs and Gibellines, of which the former was attached to the popes, and the latter to the emperor; and both, by their virulence and inveteracy, tended to disquiet the empire for several ages. The emperors too were often at war with the infidels; and sometimes, as happens in all elective kingdoms, with one another, about the succession.

But what more deserves our attention is the progress of government in Germany, which was in some measure opposite to that of the other kingdoms of Europe. When the empire raised by Charlemagne fell asunder, all the different independent princes assumed the right of election; and those now distinguished by the name of *electors* had no peculiar or legal influence in appointing a successor to the imperial throne; they were only the officers of the king's household, his secretary, his steward, chaplain, marshal, or master of his horse, &c. By degrees, however, as they lived near the king's person, and had, like all other princes, independent territories belonging to them, they increased their influence and authority; and in the reign of Otho III. 984, acquired the sole right of electing the emperor. Thus, while in the other kingdoms of Europe, the dignity of the great lords, who were all originally allodial or independent barons, was diminished by the power of the king, as in France, and by the influence of the people as in Great Britain; in Germany, on the other hand, the power of the electors was raised upon the ruins of the emperor's supremacy, and of the people's jurisdiction. In 1440, Frederic III. duke of Austria was elected emperor, and the imperial dignity continued in the male line of that family for 300 years. His successor Maximilian married the heiress of Charles duke of Burgundy; whereby Burgundy and the 17 provinces of the Netherlands were annexed to the house of Austria. Charles V. grandson of Maximilian, and heir to the kingdom of Spain, was elected emperor in the year 1519. Under him MEXICO and PERU were conquered by the Spaniards; and in his reign happened the REFORMATION in several parts of Germany; which, however, was not confirmed by public authority till the year 1648, by the treaty of Westphalia, and in the reign of Ferdinand III. The reign of Charles V. was continually disturbed by his wars with the German princes and the French king Francis I. Though successful in the beginning of his reign, his good fortune towards the conclusion of it began to forsake him; which, with other reasons, occasioned his abdication of the crown. See CHARLES V.

His brother Ferdinand I. who in 1558 succeeded to the throne, proved a moderate prince with regard to religion. He had the address to get his son Maximilian declared king of the Romans in his own lifetime,

time, and died in 1564. By his last will he ordered, that if either his own male issue, or that of his brother Charles, should fail, his Austrian estates should revert to his second daughter Anne, wife to the elector of Bavaria, and her issue. We mention this destination, as it gave rise to the late opposition made by the house of Bavaria to the pragmatic sanction, in favour of the empress queen of Hungary, on the death of her father Charles VI. The reign of Maximilian II. was disturbed with internal commotions, and an invasion from the Turks: but he died in peace in 1576. He was succeeded by his son Rodolph; who was involved in wars with the Hungarians, and in differences with his brother Matthias, to whom he ceded Hungary and Austria in his lifetime. He was succeeded in the empire by Matthias; under whom the reformers, who went under the names of *Lutherans* and *Calvinists*, were so much divided among themselves, as to threaten the empire with a civil war. The ambition of Matthias at last tended to reconcile them; but the Bohemians revolted, and threw the imperial commissaries out of a window at Prague. This gave rise to a ruinous war, which lasted 30 years. Matthias thought to have exterminated both parties; but they formed a confederacy, called the *Evangelic League*, which was counterbalanced by a Catholic league.

Matthias dying in 1618, was succeeded by his cousin Ferdinand II.; but the Bohemians offered their crown to Frederic the elector Palatine, the most powerful Protestant prince in Germany, and son-in-law to his Britannic majesty James I. That prince was incautious enough to accept of the crown: but he lost it, by being entirely defeated by the duke of Bavaria and the imperial generals at the battle of Prague; and he was even deprived of his electorate, the best part of which was given to the duke of Bavaria. The Protestant princes of Germany, however, had among them at this time many able commanders, who were at the head of armies, and continued the war with wonderful obstinacy: among them were the margrave of Baden Durlach, Christian duke of Brunswick, and Count Mansfeld; the last was one of the best generals of the age. Christiern IV. king of Denmark declared for them; and Richelieu, the French minister, was not fond of seeing the house of Austria aggrandized. The emperor, on the other hand, had excellent generals; and Christiern, having put himself at the head of the evangelic league, was defeated by Tilly, an Imperialist of great reputation in war. Ferdinand made so moderate a use of his advantages obtained over the Protestants, that they formed a fresh conspiracy at Leipsic, of which the celebrated Gustavus Adolphus king of Sweden was the head. An account of his glorious victories is given under the article SWEDEN. At last he was killed at the battle of Lutzen in 1632. But the Protestant cause did not die with him. He had brought up a set of heroes, such as the duke of Saxe Weimer, Torstenson, Banier, and others, who shook the Austrian power; till under the mediation of Sweden, a general peace was concluded among all the belligerent powers, at Munster, in the year 1648: which forms the basis of the present political system of Europe.

Ferdinand II. was succeeded by his son Ferdinand III. This prince died in 1657; and was succeeded by the emperor Leopold, a severe, unamiable, and not very fortunate prince. He had two great powers to contend with, France on the one side, and the Turks on the other; and was a loser in his war with both. Louis XIV. at that time king of France, was happy in having the two celebrated generals Condé and Turenne in his service. The latter had already distinguished himself by great exploits against the Spaniards; and, on the accession of Leopold, the court of France had taken the opportunity of confirming the treaty of Munster, and attaching to her interest several of the independent princes of Germany. The tranquillity which now took place, however, was not established upon any permanent basis. War with Spain was resumed in the year 1668; and the great successes of Turenne in the Netherlands stimulated the ambition of the prince of Condé, to attempt the conquest of Franche Compté, at that time under the protection of the house of Austria. This was accomplished in three weeks: but the rapid success of Louis had awakened the jealousy of his neighbours to such a degree, that a league was formed against him by England, Holland, and Sweden; and the French monarch, dreading to enter the lists with such formidable enemies, consented to the treaty of Aix-la-Chapelle, by which, among other articles, Franche Compté was restored. The flames of war, however, were renewed by the insatiable ambition of the French monarch; who, having entered into an alliance with Charles II. of England, aimed at nothing less than the total overthrow of the Dutch republic. The events of that war are related under the article UNITED PROVINCES; here it is sufficient to observe, that the misfortunes of the Dutch excited the compassion of the emperor and court of Spain, who now openly declared themselves their allies. Turenne was opposed by the prince of Orange in conjunction with the celebrated Imperial general Montecuculi, whose artful conduct eluded even the penetration of Turenne, and he sat down suddenly before the city of Bonne. Here he was joined by the prince of Orange, who had likewise found means to elude the vigilance of the French generals. Bonne surrendered in a short time, and several other places in Cologne fell into the hands of the allies; who likewise cut off the communication betwixt France and the United Provinces; so that Louis was soon obliged to recal his armies, and abandon all his conquests with greater rapidity than they had been made. In 1674 he was abandoned by his ally Charles II. of England, and the bishop of Munster and elector of Cologne were compelled to renounce their allegiance to him; but notwithstanding these misfortunes, he continued everywhere to make head against his enemies, and even meditated new conquests. With a powerful army he again invaded Franche Compté in person, and in six weeks reduced the whole province to his obedience. In Alsace, Turenne defeated the Imperial general at Sintzheim, and ravaged the palatinate. Seventy thousand Germans were surprised; a considerable detachment was cut in pieces at Mulhausen; the elector of Brandenburg, who had been intrusted with the chief command, was routed by Turenne near Colmar; a third body met with a similar fate at Turkheim; and the whole German forces were obliged at last to evacuate the province and repass the Rhine.

Germany.

In consequence of these disasters the imperial general Montecuculi was recalled to act against Turenne. The military skill of the two commanders seemed to be nearly equal; but before the superiority could be adjudged to either, Turenne was killed by a cannon ball as he was reconnoitring a situation for erecting a battery. By his death the Imperialists obtained a decided superiority. Montecuculi penetrated into Alsace; and the French, under De Lorges nephew to the deceased general, were happy in being able to escape a defeat.

Part of the German army now sat down before Treves, where they were opposed by Mareschal Crequi; but the negligence of that general exposed him to such a dreadful defeat, that he was obliged to fly into the city with only four attendants. Here he endeavoured in vain to animate the people to a vigorous defence. The garrison mutinied against his authority; and, when he refused to sign the capitulation they made, delivered him up prisoner to the enemy. Louis in the mean time had taken the field in person against the prince of Orange; but the disastrous state of affairs in Germany induced him to recal the prince of Condé to make head against Montecuculi. In this campaign the prince seemed to have the advantage. He compelled the Germans to raise the sieges of Hagenau and Saverne; and at last to repass the Rhine without having been able to force him to a battle.

This was the last campaign made by these celebrated commanders; both of them now, contented with the fame they had acquired, retiring from the field to spend the remainder of their days in peace. The excellent discipline, however, which the two great French generals had introduced into their armies, still continued to make them very formidable, though it did not always ensure them of victory. In Germany, the duke of Lorrain, who had recovered Philipsburg, was repeatedly defeated by Mareschal Crequi, who had been ransomed from his captivity, and become more prudent by his defeat. In Flanders, the prince of Orange was overmatched by the duke of Orleans and Marshal Luxemburg. A peace was at length concluded at Nimeguen in 1679, by which the king of France secured himself Franche Compté with a great many cities in the Netherlands; while the king of Sweden was reinstated in those places of which he had been stripped by the Danes and Germans. This tranquillity, however, was of no long duration. Louis emoloyed every moment in preparations for new conquests; possessed himself of the imperial city of Strasburg by treachery; and dispossessed the elector Palatine and the elector of Treves of the lordships of Falkemburg, Germansheim, and Valdentz. On the most frivolous pretences he had demanded Alost from the Spaniards; and on their refusal, seized upon Luxemburg. His conduct, in short, was so intolerable, that the prince of Orange, his inveterate enemy, found means to unite the whole empire in a league against him. Spain and Holland became parties in the same cause; and Sweden and Denmark seemed also inclined to accede to the general confederacy. Notwithstanding this formidable combination, however, Louis seemed still to have the advantage. He made himself master of the cities of Philipsburg, Manheim, Frankendal, Spires, Worms, and Oppenheim: the fruitful country of the Palatinate was ravaged in a dreadful manner; the towns were reduced to ashes; and the people, driven from their habitations, were everywhere left to perish through the inclemency of the weather and want of provisions. By this cruelty his enemies were rather exasperated than vanquished: the Imperialists, under the conduct of the duke of Lorrain, resumed their courage, and put a stop to the French conquests. At length all parties, weary of a destructive war, consented to the treaty of Ryswick in 1697. By this treaty Louis gave up to the empire, Fribourg, Brisac, Kheil, and Philipsburg; he consented also to destroy the fortifications of Strasburg. Fort Louis and Traerbach, the works of which had exhausted the skill of the great Vauban, with Lorrain, Treves, and the Palatinate, were resigned to their respective princes; insomuch that the terms to which the French monarch now consented, after so many victories, were such as could scarce have been expected under the pressure of the greatest misfortunes. The views of Louis, however, in consenting to this apparently humiliating treaty, were beyond the views of ordinary politicians. The health of the king of Spain was in such a declining way, that his death appeared to be at hand; and Louis now resolved to renew his pretensions to that kingdom, which he had formerly by treaty solemnly renounced. His designs in this respect could not be concealed from the vigilance of William III. of Britain; of which Louis being sensible, and knowing that the emperor had claims of the same nature on Spain, he thought proper to enter into a very extraordinary treaty with William. This was no less than the partition of the whole Spanish dominions, which were now to be distributed in the following manner. To the young prince of Bavaria were to be assigned Spain and the East Indies; the dauphin, son to Louis, was to have Naples, Sicily, and the province of Guipuscoa; while the archduke Charles, son to the emperor Leopold, was to have only the duchy of Milan. By this scandalous treaty the indignation of Charles was roused, so that he bequeathed the whole of his dominions to the prince of Bavaria. This scheme, however, was disconcerted by the sudden death of the prince; upon which a new treaty of partition was concluded between Louis and William. By this the kingdom of Spain, together with the East India territories, were to be bestowed on the archduke Charles, and the duchy of Milan upon the duke of Lorrain. The last moments of the Spanish monarch were disturbed by the intrigues of the rival houses of Austria and Bourbon; but the haughtiness of the Austrian ministers so disgusted those of Spain, that they prevailed upon their dying monarch to make a new will. By this the whole of his dominions were bequeathed to Philip duke of Anjou, grandson to the king of France; and Louis, prompted by his natural ambition, accepted the kingdom bequeathed to his grandson, excusing himself to his allies in the best manner he could for departing from his engagements with them. For this, however, he was made to pay dear. His insatiable ambition and his former successes had alarmed all Europe. The emperor, the Dutch, and the king of England, entered into a new confederacy against him; and a bloody war ensued, which threatened to to overthrow the French monarchy entirely. While this war (of which an account is given under the article BRITAIN) was carried on with such success, the emperor Leopold died in the year 1705.

He was succeeded by his son Joseph, who put the electors of Cologne and Bavaria to the ban of the empire; but being ill served by Prince Louis of Baden, general of the empire, the French partly recovered their affairs, notwithstanding their repeated defeats. The duke of Marlborough had not all the success he expected or deserved. Joseph himself was suspected of a design to subvert the Germanic liberties; and it was plain by his conduct, that he expected England should take the labouring oar in the war, which was to be entirely carried on for his benefit. The English were disgusted at his slowness and selfishness: but he died in 1711, before he had reduced the Hungarians; and leaving no male issue, he was succeeded in the empire by his brother Charles VI. whom the allies were endeavouring to place on the throne of Spain, in opposition to Philip duke of Anjou, grandson to Louis XIV.

When the peace of Utrecht took place in 1713, Charles at first made a show as if he would continue the war; but found himself unable, now that he was forsaken by the English. He therefore was obliged to conclude a peace with France at Baden in 1714, that he might attend the progress of the Turks in Hungary; where they received a total defeat from Prince Eugene at the battle of Peterwaradin. They received another of equal importance from the same general in 1717, before Belgrade, which fell into the hands of the Imperialists; and next year the peace of Passarowitz, between them and the Turks, was concluded. Charles employed every minute of his leisure in making arrangements for increasing and preserving his hereditary dominions in Italy and the Mediterranean. Happily for him, the crown of Britain devolved to the house of Hanover; an event which gave him a very decisive weight in Europe, by the connexions between George I. and II. and the empire. Charles was sensible of this; and carried matters with so high a hand, that, about the years 1724 and 1725, a breach ensued between him and George I. and so unsteady was the system of affairs all over Europe at that time, that the capital powers often changed their old alliances, and concluded new ones contradictory to their interest. Without entering into particulars, it is sufficient to observe, that the safety of Hanover, and its aggrandizement, was the main object of the British court; as that of the emperor was the establishment of the pragmatic sanction in favour of his daughter (the late empress queen), he having no male issue. Mutual concessions upon those great points restored a good understanding between George II. and the emperor Charles: and the elector of Saxony, flattered with the view of gaining the throne of Poland, relinquished the great claims he had upon the Austrian succession.

The emperor, after this, had very bad success in a war he entered into with the Turks, which he had undertaken chiefly to indemnify himself for the great sacrifices he had made in Italy to the princes of the house of Bourbon. Prince Eugene was then dead, and he had no general to supply his place. The system of France, however, under Cardinal Fleury, happened at that time to be pacific; and she obtained for him, from the Turks, a better peace than he had reason to expect. Charles, to keep the German and other powers easy, had, before his death, given his eldest daughter, the late empress queen, in marriage to the duke of Lorrain, a prince who could bring no accession of power to the Austrian family.

Charles died in 1740; and was no sooner in the grave, than all he had so long laboured for must have been overthrown, had it not been for the firmness of George II. The young king of Prussia entered and conquered Silesia, which he said had been wrongfully dismembered from his family. The king of Spain and the elector of Bavaria set up claims directly incompatible with the pragmatic sanction, and in this they were joined by France; though all those powers had solemnly guaranteed it. The imperial throne, after a considerable vacancy, was filled up by the elector of Bavaria, who took the title of *Charles VII.* in January 1742. The French poured their armies into Bohemia, where they took Prague; and the queen of Hungary, to take off the weight of Prussia, was forced to cede to that prince the most valuable part of the duchy of Silesia by a formal treaty.

Her youth, her beauty, and sufferings, and the noble fortitude with which she bore them, touched the hearts of the Hungarians, into whose arms she threw herself and her little son; and though they had been always remarkable for their disaffection to the house of Austria, they declared unanimously in her favour. Her generals drove the French out of Bohemia; and George II. at the head of an English and Hanoverian army, gained the battle of Dettingen, in 1743. Charles VII. was at this time miserable on the imperial throne, and would have given the queen of Hungary almost her own terms; but she haughtily and impolitically rejected all accommodation, though advised to it by his Britannic majesty, her best and indeed only friend. This obstinacy gave a colour for the king of Prussia to invade Bohemia, under pretence of supporting the imperial dignity; but though he took Prague, and subdued the greatest part of the kingdom, he was not supported by the French; upon which he abandoned all his conquests, and retired into Silesia. This event confirmed the obstinacy of the queen of Hungary: who came to an accommodation with the emperor, that she might recover Silesia. Soon after, his Imperial majesty, in the beginning of the year 1755, died; and the duke of Lorrain, then grand duke of Tuscany, consort to the queen of Hungary, after surmounting some difficulties, was chosen emperor.

The bad success of the allies against the French and Bavarians in the Low Countries, and the loss of the battle of Fontenoy, retarded the operations of the empress queen against his Prussian majesty. The latter beat the emperor's brother, Prince Charles of Lorrain, who had before driven the Prussians out of Bohemia; and the conduct of the empress queen was such, that his Britannic majesty thought proper to guarantee to him the possession of Silesia, as ceded by treaty. Soon after, his Prussian majesty pretended that he had discovered a secret convention which had been entered into between the empress queen, the empress of Russia, and the king of Poland as elector of Saxony, to strip him of his dominions, and to divide them

Germany.

them among themselves. Upon this his Prussian majesty, very suddenly, drove the king of Poland out of Saxony, defeated his troops, and took possession of Dresden; which he held till a treaty was made under the mediation of his Britannic majesty, by which the king of Prussia acknowledged the duke of Lorrain, great duke of Tuscany, for emperor. The war, however, continued in the Low Countries, not only to the disadvantage, but to the discredit of the Austrians and Dutch, till it was finished by the treaty of Aix-la-Chapelle, in April 1748. By that treaty Silesia was once more guaranteed to the king of Prussia. It was not long before that monarch's jealousies were renewed and verified; and the empress of Russia's views falling in with those of the empress queen and the king of Poland, who were unnaturally supported by France in their new schemes, a fresh war was kindled in the empire. The king of Prussia declared against the admission of the Russians into Germany, and his Britannic majesty against that of the French. Upon these two principles all former differences between these monarchs were forgotten, and the British parliament agreed to pay an annual subsidy of 670,000l. to his Prussian majesty during the continuance of the war.

The flames of war now broke out in Germany with greater fury and more destructive violence than ever. The armies of his Prussian majesty, like an irresistible torrent, burst into Saxony; totally defeated the imperial general Brown at the battle of Lowositz; forced the Saxons to lay down their arms; though almost impregnably fortified at Pirna; and the elector of Saxony fled to his regal dominions in Poland. After this, his Prussian majesty was put to the ban of the empire; and the French poured, by one quarter, their armies, as the Russians did by another, into the empire. The conduct of his Prussian majesty on this occasion is the most amazing that is to be met with in history; for a particular account of which, see the article PRUSSIA.

At last, however, the taking of Colberg by the Russians, and of Schweidnitz by the Austrians, was on the point of completing his ruin, when his most formidable enemy, the empress of Russia, died January 5. 1762; George II. his only ally, had died on the 25th of October 1760.

The deaths of those illustrious personages were followed by great consequences. The British ministry of George III. sought to finish the war with honour, and the new emperor of Russia recalled his armies. His Prussian majesty was, notwithstanding, so very much reduced by his losses, that the empress queen, probably, would have completed his destruction, had it not been for the wise backwardness of other German princes, not to annihilate the house of Brandenburg. At first the empress queen rejected all terms proposed to her, and ordered 30,000 men to be added to her armies. The visible backwardness of her generals to execute her orders, and new successes obtained by his Prussian majesty, at last prevailed on her to agree to an armstice, which was soon followed by the treaty to Hubertsburgh, which secured to his Prussian majesty the possession of Silesia. Upon the death of the emperor her husband, in 1765, her son Joseph, who had been crowned king of the Romans in 1764, succeeded him in the empire.

This prince showed an active and restless disposition, much inclined to extend his territories by conquest, and to make reformations in the internal policy of his dominions, yet without taking any proper methods for accomplishing his purposes. Hence he was almost always disappointed; insomuch that he wrote for himself the following epitaph: "Here lies Joseph, unfortunate in all his undertakings." In the year 1778, a war commenced betwixt him and the king of Prussia; in which, notwithstanding the impetuous valour of that monarch, Joseph acted with such caution that his adversary could gain no advantage over him; and an accommodation took place without any remarkable exploit on either side. In 1781 he took the opportunity of the quarrel betwixt Britain and the United Provinces, to deprive the latter of the barrier towns which had been secured to them by the treaty of Utrecht. These indeed had frequently been of great use to the house of Austria in its state of weakness; but Joseph, conscious of his own strength, looked upon it as derogatory to his honour to allow so many of his cities to remain in the hands of foreigners, and to be garrisoned at his expence. As at that time the Dutch were unable to resist, the imperial orders for evacuating the barrier towns were instantly complied with; nor did the court of France, though then in friendship with Holland, make any offer to interpose. Encouraged by this success, Joseph next demanded the free navigation of the Scheldt; but as this would evidently have been very detrimental to the commercial interests of Holland, a flat refusal was given to his requisitions. In this the emperor was much disappointed; having flattered himself that the Hollanders, intimidated by his power, would yield the navigation of the river as easily as they had done the barrier. Great preparations were made by the emperor, which the Dutch, on their part, seemed determined to resist. But while the emperor appeared so much set upon this acquisition, he suddenly abandoned the project entirely, and entered into a new scheme of exchanging the Netherlands for the duchy of Bavaria. This was opposed by the king of Prussia; and by the interference of the court of France, the emperor found himself at last obliged also to abandon his other scheme of obtaining the navigation of the Scheldt. A treaty of peace was concluded, under the guarantee of his most Christian majesty. The principal articles were, that the states acknowledged the emperor's sovereignty over the Scheldt from Antwerp to the limits of Seftingen; they agreed to demolish certain forts, and to pay a considerable sum of money in lieu of some claims which the emperor had on Maestricht, and by way of indemnification for laying part of his territories under water.

The treaty with the Dutch was no sooner concluded than a quarrel with the Turks took place, which terminated in an open war. It does not appear that the emperor had at this time any real provocation, but seems to have acted merely in consequence of his engagements with Russia to reduce the dominions of the Grand Signior. All these foreign engagements, however, did not in the least retard the progress of reformation which the emperor carried on throughout his dominions with a rapidity scarcely to be matched, and which at last produced the revolt of the Austrian Netherlands. In the course of his labours in this way, a complete

 complete code of laws was compiled. These were at first greatly commended for their humanity, as excluding almost entirely every species of capital punishment; yet, when narrowly considered, the commutations were found to be so exceedingly severe, that the most cruel death would, comparatively speaking, have been an act of mercy. Even for smaller crimes the punishments were severe beyond measure; but the greatest fault of all was, that the modes of trial were very defective, and the punishments so arbitrary, that the most perfect and innocent character lay at the mercy of a tyrannical judge. The innovations in ecclesiastical matters were, however, most offensive to his subjects in the Netherlands. Among the many changes introduced into this department, the following were some of the most remarkable. 1. An abridgment of divine service. 2. A total suppression of vocal performers in choirs. 3. The introduction of the vernacular language instead of the Latin in administering the sacraments. 4. The prohibition of chanting hymns in private houses. 5. The suppression of a great number of religious houses, and the reduction of the number of the clergy. 6. The total abolition of the papal supremacy throughout the imperial dominions. The same spirit of innovation displayed itself even in the most minute matters. Many favours were bestowed upon the Jews; and in 1786 the emperor wrote with his own hand to the different handicraft and trading corporations in Vienna, requesting that their youths might be received as apprentices in that city. Severe laws against gaming were enacted and put in execution with equal rigour. Heavy restrictions were also laid on all the societies of free masons in Germany, while those in the Netherlands were totally suppressed.

The great number of innovations in religious matters were highly resented by the inhabitants of the Netherlands, who have always been remarkable for their attachment to the Romish religion in its most superstitious form. Indeed the alterations in the civil constitution were so great, that even those who were least bigotted in this respect began to fear that their liberties were in danger, and an universal dissatisfaction was excited. The emperor behaved at first in a very haughty manner, and refused to yield the smallest point to the solicitations of his subjects. Finding, however, that a general revolt was about to take place, and being unable at that time, on account of the Turkish war, to spare such a force as would be necessary to reduce the provinces to obedience, he thought proper, in the autumn of 1787, to promise a restoration of their ancient constitution and privileges. His promises, however, were found to be so delusive, and his conduct was so arbitrary and capricious, that in the end of the year 1789 the states of all the provinces in the Austrian Netherlands came to a resolution of entirely throwing off the yoke. Articles of a federal union were drawn up, and a new republic was formed under the title of the *Belgic Provinces.* The situation of the emperor's affairs at that time did not allow him to take the measures necessary for preventing this revolt; to which perhaps his ill state of health also contributed. About the beginning of February 1790 his distemper increased to such a degree as to be thought dangerous; and continuing daily to grow worse, he sunk under it on the 20th of the same month, in the 40th year of his age, and 26th of his reign.

The leaders of the revolution, however, soon became so disagreeable to their countrymen, that they were obliged to fly. Joseph's successor, Leopold, adopted a more conciliatory policy, and the troubles in the Netherlands were at length calmed.

The Netherlands, which the French had overrun in 1794, were annexed to France by the treaty of Campo Formio in 1797. This was the amputation of a limb from the Germanic body; but the further changes which this measure introduced were not completed till 1801, when the three ecclesiastical electorates, Mentz, Triers, and Cologne, were abolished, and in their room were created four new electorates, Baden, Wirtemberg, Hesse Cassel, and Saltzburg. Many bishoprics and abbeys were at the same time secularized, and a number of free towns disfranchised, to afford indemnities to the princes who were deprived of their possessions on the left bank of the Rhine. In 1806, after the battle of Austerlitz, farther changes were made, which entirely abolished the ancient Germanic constitution. The emperor Francis renounced the title of emperor of Germany, and assumed that of emperor of Austria. The princes of Bavaria, Wirtemberg, and Saxony assumed the title of king; and these, with nearly all the other small states, were united into a body, named the Confederation of the Rhine, of which the emperor Napoleon was head. This body was dissolved in 1813, when the French were driven within the Rhine; but its constitution served as the model for the new Germanic confederation, which was established in 1814 by the congress of Vienna.

21 Constitution of the empire.

Monarchy was first established in Germany by Clodovick: after him Charlemagne extended his power and his dominions; and so great had the empire become, that during his reign, and that of his son, government was administered in the provinces by persons vested with power for that purpose under the title of *Dukes.* In the districts of these provinces, justice was distributed by a *comes* or count, which officer was in Germany called *Graf.* But from their courts lay an appeal to that of the emperor, before a president styled *Comes Palatinus*, that is, "Count Palatine, or of the palace," in German denominated *Psalzgraf.* The frontiers or marches were governed by a marquis, styled by the Germans *Markgraf*, similar to our lord warden. Generally the centre of the empire was ruled by an officer who possessed a similar power, but a greater extent of dominion, than the Grave, under the title of *Landgrave.* Towns and castles, which were occasionally honoured with the residence of the emperor, were governed by a Burggraf. It may be remarked, that the signification of the above-mentioned titles, and the extent of power which they conferred upon the persons honoured with them, differ according to the successive ages and the gradual developement of the German constitution.

By reason of family broils in the imperial house, and civil wars in their dominions, the dignity of the sovereign was depressed, and a new form in the government raised up. The dukes exalted themselves above the power of the emperor, and secured for their sons a succession to their greatness; while the interest of the

Germany. the sovereign, in order to strengthen the bond of personal attachment, ratified to others and their descendants that sway which had been formerly delegated and dependant on his will. Hence arose the modern constitution of distinct principalities, acknowledging one head in the person of an emperor. But shortly after the election of Conrade duke of Franconia to the throne, this new-gained authority of the princes became doubtful. However, after most violent disturbances and confusions, the regulations yielded to by Albert II. and his successors, particularly by Frederick III. laid the foundation of the German constitution; but the power and form of which were afterwards improved by Maximilian. Before Charles V. mounted the throne, on the death of Maximilian, the electors formed a bulwark against the Imperial power, by an instrument called the *capitulation;* to which articles of government he and all emperors elected since have sworn, previous to their investiture with the Imperial dignity.

22 Of the electors.

When the German monarchy received an elective form, the right of election was not limited to the great officers of state, for other princes participated of this privilege. But the empire being governed by four dukes, the princes under their authority, in order to court their favour, gave to them the disposal of their votes, and of those of their vassals. The three archbishops also, who were necessarily present at the coronation, obtained the electoral dignity. However, beside this origin of the modern electors, the high-stations about court procured their possessors an influence over other members, and their general residence there gave them a solid advantage in their constant and early presence at the diet of election. For in times of turbulence several emperors were elected, when the princes had not an opportunity to attend. And hence sprung up a sanction to that right, which the high officers of the household had assumed, of electing without any consultation of the other members of the empire. Pope Gregory X. too, either conceiving that they did possess, or willing that they should acquire, this right, exhorted them in a bull to terminate the troubles of Germany by electing an emperor. And since that period they have been held as the sole electors. But the possession of this high power was strengthened by a league amongst themselves, called the *electoral union*, which received additional confirmation from the emperor Louis of Bavaria, and was formally and fully ratified by that famous constitution of Charles IV. termed the *golden bull;* according to which, the territories and the high officers by which the electoral dignity is conveyed, must descend according to the right of primogeniture, and are indivisible.

The golden bull declares the following number and titles of the electors: The archbishop of Mentz as great chancellor of the German empire; the elector of Cologne as great chancellor of the empire in Italy; the elector of Triers as great chancellor of the empire in Gaul and Arles; the king of Bohemia as cupbearer; the count Palatine as high steward; the duke of Saxony as grand marshal; the margrave of Brandenburg as grand chamberlain. The number originally was seven, but the emperor Leopold created the duke of Lunenburg, ancestor to our present British sovereign, an elector; to whom the post of arch-treasurer was afterwards given; and thus Hanover forms the eighth electorate. But this number cannot be increased by the emperor without a previous election by the electors themselves; who, thus capable of electing and of being elected, may style themselves *Coimperantes;* and they exercise part of the imperial authority, if a vacancy of the throne happen. But when or before this occurs, the election of the emperor is proceeded to after the following manner: The elector of Mentz, before the lapse of a month after the death of the emperor, summons, as great chancellor of the empire, the rest of the electors to attend on some fixed day within the space of three months from the date of the summons. The electors generally send their ambassadors to the place of election, which is held at Frankfort on the Mayne; but saving the right of the city of Frankfort, it may be held elsewhere.

23 Election of the emperor.

When the diet of electors is assembled, they proceed to compose the capitulation, to which the emperor when elected is to swear. The capitulation being adjusted, the elector of Mentz appoints a day for the election. When this day arrives, the gates of the city are shut, and the keys delivered to the elector of Mentz. The electors or their ambassadors, Protestants excepted, repair in great pomp to mass; and after its celebration they take a solemn oath to choose, unbiassed and uninfluenced, the person that appears most proper for the imperial dignity. After this they repair to the sacristy, where the elector of Mentz first asks, if there be any impediment known against their proceeding at present to an election; and next he obtains a promise, that the person elected by the majority shall be received as emperor. The declarations of the electoral ambassadors, in respect to those two points, are recorded by two notaries of the empire. Then all witnesses withdraw; and the elector of Mentz collecting the suffrages, which are *viva voce*, and giving his own last, the witnesses are recalled, and he declares the person whom the electors have chosen. But the election is not complete, nor is the new emperor proclaimed, until the capitulation be sworn to either by himself or by his ambassadors if he be absent. From this time he is styled king of the Romans until the coronation takes place; which ceremony confers the title of emperor. According to the golden bull, it should be celebrated at Aix-la-Chapelle, out of respect to Charlemagne, who resided there; but saving the right to Aix-la-Chapelle, it may take place elsewhere. The coronation is performed by the archbishop of Mentz or elector of Cologne. And, when he is seated on his throne, the duke of Saxony delivers into his hand the sword of Charles the Great, with which he makes some knights of the holy Roman empire, and is also obliged to confer that honour upon such others as are nominated by the respective electors. When he proceeds to dinner in the great hall, he is seated at a table elevated two steps higher than that of the electors, and is served by counts of the empire. The electors, each of whom has also his table, are attended by the gentlemen of their respective courts. These electors, who assist personally at the ceremony,

 remony, sit and eat at their own tables; but those who are represented by ambassadors have only their tables covered out of form with plates, at which the ambassadors do not sit.

For the benefit of the empire during the reign of an emperor, his presumptive successor may be elected king of the Romans. But this election confers at first a mere title; for by an express article in his capitulation, the king of the Romans swears not to interfere with the government during the life of the emperor; but on his decease the coronation confirms him emperor without a second election.

Should there not be a king of the Romans, and the throne become vacant, the government is administered by vicars of the empire, who are the electors Palatine and of Saxony, as count palatine and arch-marshal of the empire. Each has his district and tribunal of the vicariate; and by the golden bull it is established, that all acts of the vicars are valid; but they are all fully confirmed by the emperor; which confirmation, by an article of his capitulation, he is bound to give.

There are also vicars of the emperor. These officers are constituted by a delegation of the imperial power from the emperor to any prince of the empire, when he is unable to execute his authority himself. But these vicars stand accountable to the emperor; their acts may be annulled and their offices revoked, all dependent on the will of the emperor, and determinable at his pleasure.

When the race of Charlemagne ceased to govern in Germany, the princes and states associated to continue the empire; and that its majesty might be visible, and its laws enforced, they agreed to choose an emperor. From this emperor all electors and princes except those before 1582 receive investiture of their dominions; counts and free cities from the Aulic council. But this investiture is no more than a sign of submission to the majesty of the empire, which is deposited in the emperor. For as the constituted members of the empire are dependent on that collective union from which they derive protection, they therefore show this dependence on the emperor, because he represents the majesty of that union or of that empire; but in all other respects they are independent and free.

These princes or sovereigns may even wage war with the prince wearing the imperial crown, as possessed of other titles and dominions unconnected with his imperial station. Nor can the sovereignty of any member be affected so long as he remains loyal to the empire; which loyalty constitutes his duty, and secures him its protection. But should he be guilty of any violation against the emperor, as head of the empire, such a crime would commit him to the punishment of its laws, and he would be put under the ban. For this crime would be against that collective body of sovereigns whose union constitutes the empire; and therefore any violation of that union is justly punished with deprivation of these territories which render such sovereigns members of the empire. Nor can this punishment of the ban derogate from the dignity of those princes who derive their sovereignty from this constitution, and whose subjection is an act of their own consent. However, no member of the empire can at present be put under the ban without being first heard, and without the concurrence of the electors, princes, and states, being previously obtained.

24 Powers of the emperor.

The emperor is endowed with many privileges, and his power partly appears in the exercise of his reserved rights, or the peculiar prerogatives annexed to the imperial dignity. He grants to princes the investiture of their dominions; but to this he is bound as the laws direct. He confers titles, but promises that they shall be bestowed only on such persons as will maintain their dignity, and can support their rank. Besides, he can give merely the title; for the power or privilege of prince or count can be obtained only from their respective bodies. But in some instances, even titles are of high importance. For the descendants of a prince are incapable of succession, if their mother be of inferior rank to their father; but the conferring of a title ennobles her and removes the bar, if the collateral line consents.

The emperor can also make cities, found universities, grant the privilege of fairs, &c. He can also dispense with the tedious terms of minority, and empower princes to assume at an earlier age the government of their own dominions. He decides all rank and precedency, and has a power of *primæ preces*, that is, of granting for once in every chapter of the empire a vacant seat. But he is not above the law; for electors have not only chosen but deposed emperors. However, the influence of the capitulation is to prevent such rigorous proceedings: but should the capitulation be violated, the college of electors might proceed to remonstrance; and if these remonstrances should be without effect, in conjunction with the diet, they might resort to more forcible remedies.

25 Diet of the empire.

The diet is that assembly of the states in which the legislative power of the empire resides; and is composed of the electors, princes, prelates, counts, and free cities of the empire. It has sat since 1663, and is held usually at Ratisbon. The emperor, when present, presides in person; when absent, by his commissary, whose communication of proposals from the emperor to the assembly is called the *commissorial decree*. The elector of Mentz, as chancellor of the empire, is director of the diet; and to his chancery are all things addressed that are to be submitted to the empire; the reading of which by his secretary to the secretaries of the other ministers at the diet is denominated *per dictaturam*, and constitutes the form of transmitting papers or memorials to the dictature of the empire.—The diet is composed of three distinct colleges, each of which has its particular director. The first college is that of electors; of which the archbishop of Mentz is director as first elector. The second college is that of princes. It consists of princes, archbishops, and bishops; and of prelates, abbots, and counts, who are not considered as princes. Each prince spiritual and temporal has a vote, but prelates and counts vote by benches. The prelates are divided into two benches, the counts into four; and each bench has only one vote. The archduke of Austria and the archbishop of Saltzburg are alternately directors of the college of princes. The third college is that of the free cities of the empire; the director of which is the minister of the city in which the diet happens to sit.

In

Germany.

In all these colleges, the sentiments of the majority are conclusive, except in respect of fundamental laws, which affect the whole empire, or such matters as relate to religion. In these they must be unanimous.

Where religion is interested, the proceedings are also different. The colleges are then considered as consisting of two bodies, the evangelic and the catholic; and if any religious point be proposed, it must meet not only the unanimous concurrence of the proposing body, but must have the majority of the other to establish it. This distinction arose from a conjunction called the *evangelic body;* which was formed by the Protestant states and princes to guard the Protestant interest in Germany, by watching over the laws for the security of their religion, and, in case of violation, by obtaining redress from the imperial throne. For in any part of the empire, as in the palatinate, where the count is a Papist and the subjects are Protestants, should oppressions arise, application would be made to the evangelic body through the director. The elector of Saxony is director of the evangelic body, though he is a Papist: but therefore his representations in favour of the Protestants have more force; and beside, should he abuse an office which invests him with considerable weight and influence, he could be instantly deprived of it.

The first two colleges are styled superior, and in effect constitute the diet: for all points that come before the diet, are generally first deliberated in the college of electors, and pass from that to the college of princes; in which, if any objection arise, a free conference takes place between the directors of each college. And should they, in consequence of this free conference, concur, they invite the third college to accede to their joint opinion; which invitation is generally complied with: but should this college return a refusal, the opinion of the other two colleges is in some few cases engrossed in the chancery, and delivered to the emperor's commissary as the opinion of the empire. The opinion of the third college is merely mentioned at the close. However, though the superior colleges do in effect constitute the diet; yet the received maxim is, that no two colleges constitute a majority, that is, the majority of voices at the diet; nor can the emperor confirm the opinion of two colleges as an opinion of the diet. By the peace of Westphalia, a decisive vote was recognized as a right of the imperial cities, which the two superior colleges should not infringe upon; their vote being, by the fundamental law, of equal weight with that of the electors and princes.

After a measure is approved of by the colleges, it is submitted to his Imperial majesty to receive his negative or confirmation. Should he approve the point, it is published in his name as the resolution of the empire, which states are exhorted to obey, and tribunals desired to consider as such.

The diet not only makes and explains laws, but decides ambiguous cases. It must also be consulted before war is made; appoints the field marshal who is to command the army, and assigns him his council of war. The diet also enters into and makes alliances, but usually empowers the emperor to negociate them; and foreign states have their ambassadors at the diet, but the diet sends no ministers to foreign courts.

26 Administration of justice, &c.

In the origin of the empire, justice was administered in the districts of the provinces by counts, and appeals lay from their courts to that of the emperor before the count palatine. But as civil broils shook the power of the emperor, they interrupted also the course of justice. The consequent inconveniences caused several solicitations to be preferred from the states to different emperors for the establishment of a court of justice, which should take cognizance of great as well as small causes. And at length such a court was erected by Maximilian I. under the title of the *Imperial Chamber at Worms*, in the year 1495; but was removed to Spires in 1533, and to Wetzlar in 1696, where it is now held. The members of this court are a judge of the chamber and 25 assessors, partly Protestants, partly Papists. The president is appointed by the emperor, the assessors by the states. The court receives appeals from inferior jurisdictions, and decides dubious titles; and all causes before it between prince and prince, or princes and private persons, are adjudged according to the laws of the respective parties, or according to the Imperial law. The tribunal is under the inspection of visitors appointed by the states; and, during their visitation, the sentences of the court are subject to revision. Appeals lie afterwards also from the judgment of the visitors to that of the diet.

27 Aulic council.

The emperors finding themselves deprived of many of their powers, wished to raise their prerogatives by forming a tribunal, of which they should name the judge, and before whom causes in the last resort should come. But Maximilian foresaw, in respect to the new tribunal, that though a consciousness of its importance made the states struggle for its erection, the expences of its establishment would make them neglect its support; and the event bore witness to his sagacity. But when, through the omissions and negligence of the states, there happened to be a cessation in the distribution of justice by the Imperial chamber, he revived his court of the count Palatine, or Aulic council. And in order to gain the quiet acquiescence of the states, under the mask of a partition of power, and of generous moderation, he desired them to add eight to the number of assessors, and the salaries of all should be discharged by him. The states swallowed the bait, but soon perceived that they had lost part of their liberty.

The emperor, by keeping the tribunal always open, by filling its seats with men of first-rate talents, and by having its sentences duly and speedily executed, drew all causes before it. The states remonstrated, declaring that the Imperial chamber ought to be not only the supreme, but sole tribunal of that kind. The emperor answered, that he had erected the Imperial chamber in consequence of their solicitations; but as they had not supplied the tribunal with judges, he provided for that deficiency by a constant administration of justice in the establishment of another.

The Aulic council now subsists with equal authority, each receiving appeals from inferior jurisdictions; but neither appealing to the other, as the *dernier resort* from both must be had to the diet. However, to the Aulic council belong the reserved rights of the emperor; and to the Imperial chamber also are annexed peculiar powers. The Imperial chamber subsists during a vacancy

Germany. cancy of the throne under the authority of the vicars of the empire; whereas the Aulic council does not exist until appointed by the succeeding emperor.

The Aulic council consists of a president, vice president, and 17 assessors, of whom six are Protestants. The vice chancellor of the empire is also entitled to a seat; and all decrees issuing from the council pass through his hands to those who are to execute them. This tribunal obtains for the emperor, through the appeals from the courts of other princes, a new authority beside that which he possesses from his reserved rights; but electors and some princes, as those of Hanover, Austria, Brunswick, Swedish Pomerania, Hesse, are free from this dependence on the emperor, to whose Aulic council their subjects cannot appeal; nor can it take cognizance of ecclesiastical or criminal causes, both of which appertain to territorial justice; which we shall presently consider when we have surveyed the executive instrument of Imperial justice.

The division of the empire into circles is a regulation coeval with the establishment of the Imperial chamber by Maximilian, in order to strengthen the arm of justice with vigour to enforce its decrees. The original division was into six circles, which are called the *ancient circles;* and are, Bavaria, Franconia, Suabia, Lower Saxony, the Upper Rhine, and Westphalia; but the powerful princes, who at first declined bringing their dominions under the form of circles, were led by a political finesse of the emperor to adopt the regulation, and increase the number to ten, by forming the four new circles of Austria, Burgundy, the Electorate Circle, and Upper Saxony.

Over these circles preside directors, to whom the tribunals of justice commit the execution of their decrees. The six old circles have two directors each, the four new have one each. The office of director is permanent and hereditary, as it belongs always to the first prince in the circle, upon whom it confers high authority; for all the decrees of the Imperial chamber and Aulic council are of no avail unless the director will execute them.

The directors of the circles are not only instruments of war but of peace: for in case of an Imperial war, they are to collect the troops of the circle; and if any state or prince of their respective circles suffers violation from others, they are to yield protection and enforce the peace; or should there be any tumultuous uprisings of the people, the suppression of such belongs to them.

The emperor is the executive instrument of the whole empire; the directors are such of the constitutive parts called circles. The prosperity and security of which being at stake, the directors, as presidents, must hold frequent diets in their respective circles, in order to consult on and adopt salutary measures for their safety and welfare: but as the interests of those near to us are generally so intimately blended with our own, that the good of either cannot be pursued without the mutual concurrence of both, there arise negotiations on particular points between the diets of different circles, which are therefore styled *confederate circles;* and these negotiations being more frequent amongst the circles of the Upper and Lower Rhine, or Westphalia, they are denominated the *corresponding circles.* Germany.

28 Powers of the German princes.

Every prince is sovereign in his own country; and may enter into alliances, and pursue by all political measures his own private interests, as other sovereigns do; for if even an imperial war be declared, he may remain neuter if the safety of the empire be not at stake.

Each state or sovereign appoints in general three colleges for its government. The first is the *geheimderath*, or privy council; the second is the *regierung*, or regency; the third the *renthcammer*, or chamber of finances. Each of these has a president; and a member of the first college is always president of the second. The geheimderath represents the prince, and superintends the other two. The regierung regulates limits of territories, holds conferences with other princes, and is in most countries a court of justice: however, in some states there is also a court of justice called *justitz department.* And besides the right of conferences assigned to the regierung by the sovereign, when there are disputes between princes, there is also an *austrage*, or arbitration appointed in order to decide them. Attention must be paid to this privilege of princes, who must be called on to appoint an austrage before resort be had to the Imperial tribunal, but to which there still lies an appeal from the judgment of the austrage. The renthcammer attends to the regulation of domains and estates, to the territorial revenues, and management of the taxes.

Such, before the French revolution, was the constitution of Germany, which is still worthy of a place in a work of this kind, from its connection with the history of that country, and indeed of Europe at large, for so many centuries. The present constitution of Germany was founded on that of the Rhenish Confederation (See CONFEDERATION OF THE RHINE, SUPPLEMENT), created by Bonaparte. The Germanic body includes *thirty-nine* states, among which are Austria, Prussia, Denmark, and the Netherlands; but these four powers rank as members only for a part of their territories. The common concerns of the whole body are managed by a diet which meets at Frankfort, and consists of 70 deputies sent from the thirty-nine states, the six greatest states sending four deputies each, others three or two, and the smallest states one. The thirty-nine states include a population of 30,355,069 (1818), upon a surface of 250,000 square miles. The military contingents of all the states amount to 120,000 in time of peace, and 301,000, or *one* in the 100 of the population, in time of war. The subjoined table exhibits the population and extent of each state, with the number of votes it has in the diet.

29 Military force.

Germany.

Population and extent of the States of the German Confederation.

	Inhabitants.	Square English Miles.	Seats in the Assembly of the States.
Austria,	9,496,853	78,912	4
Prussia,	8,187,220	70,549	4
Bavaria,	3,513,490	30,997	4
Saxony,	1,206,034	7,200	4
Hanover,	1,314,124	14,720	4
Wurtemberg,	1,397,451	7,524	4
Baden,	1,001,630	5,803	4
Hesse-Cassel,	545,208	4,352	3
Hesse-Darmstadt,	633,026	4,117	3
Holstein,	359,985	3,691	3
Luxemburg,	214,058	2,347	3
Saxe-Weimar,	192,371	1,408	1
Saxe-Gotha,	182,311	1,152	1
Saxe-Meiningen,	56,269	384	1
Saxe-Hildburghausen,	29,706	213	1
Saxe-Coburg,	80,012	471	1
Brunswick,	209,527	1,514	2
Mecklenburg Schwerin,	351,908	4,755	2
Mecklenburg Strelitz,	71,769	768	1
Oldenburg,	225,349	2,752	1
Nassau,	302,769	2,164	2
Anhalt Dessau,	52,947	363	1
Anhalt Bernburg,	37,046	340	1
Anhalt Kothen,	32,454	331	1
Schwartzenburg, Sonderhausen,	45,120	384	1
Schwartzenburg, Rudolstadt,	53,940	448	1
Hohenzollern, Hechingen,	14,500	117	1
Hohenzollern, Sigmaringen,	37,032	426	1
Liechtenstein,	5,546	53	1
Reuss, elder branch,	22,255	153	1
Reuss, younger branch,	52,205	458	1
Lippe-Detmold,	69,062	436	1
Schaunburg-Lippe,	23,684	213	1
Waldeck,	51,877	459	1
Hesse Homburg,	19,823	138	1
Frankfort,	47,372	113	1
Lubeck,	43,127	122	1
Bremen,	46,270	72	1
Hamburg,	129,739	134	1
	30,355,069	250,552	70

30 Character of the ancient Germans.

With regard to the character of the ancient Germans, they are described to us by the Greek and Roman writers as resembling the Gauls; and differing from other nations by the largeness of their stature, ruddy complexion, blue eyes, and yellow bushy hair, haughty and threatening looks, strong constitutions, and being proof against hunger, cold, and all kinds of hardship.

Their native disposition displayed itself chiefly in the martial genius, and in their singular fidelity. The former of these they did indeed carry to such an excess as came little short of downright ferocity; but, as to the latter, they not only valued themselves highly upon it, but were greatly esteemed by other nations for it; insomnch that Augustus, and several of his successors, committed the guard of their persons to them, and almost all other nations either courted their friendship and alliance, or hired them as auxiliaries; though it must be owned, at the same time, that their extreme love of liberty, and their hatred of tyranny and oppression, have often hurried them to treachery and murder, especially when they have thought themselves ill used by those who hired them; for in all such cases they were easily stirred up, and extremely vindictive. In other cases, Tacitus tells us, they were noble, magnanimous, and beneficent, without ambition to aggrandize their dominions, or invading those from whom they received no injury; rather choosing to employ their strength and valour defensively than offensively; to preserve their own, than to ravage their neighbours.

Their friendship and intercourse was rather a compound of honest bluntness and hospitality, than of wit, humour, or gallantry. All strangers were sure to meet with a kind reception from them to the utmost of their ability: even those who were not in a capacity to entertain them, made it a piece of duty to introduce them to those who could; and nothing was looked upon as more scandalous and detestable, than to refuse them either the one or the other. They do not seem, indeed, to have had a taste for grand and elegant entertainments; they affected in every thing, in their houses, furniture, diet, &c. rather plainness and simplicity, than sumptuousness and luxury. If they learned of the Romans and Gauls the use of money, it was rather because they found it more convenient than their ancient way of bartering one commodity for another; and then they preferred these ancient coins which had been stamped during the times of the Roman liberty, especially such as were either milled or cut in the rims, because they could not be so easily cheated in them as in some others, which were frequently nothing but copper or iron plated over with silver. This last metal they likewise preferred before gold, not because it made a greater show, but because it was more convenient for buying and selling: And as they became in time more feared by, or more useful to, the Romans; so they learned how to draw enough of it from them to supply their whole country, besides what flowed to them from other nations.

As they despised superfluities in other cases, so they did also in the connubial way: every man was contented with one wife, except some few of their nobles, who allowed themselves a plurality, more for show than pleasure; and both were so faithful to each other, and chaste, true, and disinterested in their conjugal affection, that Tacitus prefers their manners in this respect to those of the Romans. The men sought not dowries from their wives, bnt bestowed them npon them. Their youth, in those cold climes, did not begin so soon to feel the warmth of love as they do in hotter ones: it was a common rule with them not to marry young; and these were most esteemed who continned longest in celibacy, because they looked upon it as an effectual means to make them

Germany. them grow tall and strong; and to marry, or be concerned with a woman, before they were full 20 years old, was accounted shameful wantonness. The women shared with their husbands not only the care of the family, and the education of their children, but even the hardships of war. They attended them in the field, cooked the victuals for them, dressed their wounds, stirred them up to fight manfully against their enemies, and sometimes have, by their courage and bravery, recovered a victory when it was upon the point of being snatched from them. In a word, they looked upon such constant attendance on them, not as a servitude, like the Roman dames, but as a duty and an honour. But what appears to have been still a harder fate upon the ancient German dames was, that their great Odin excluded all those from his *valhalla* or paradise, who did not, by some violent death, follow their deceased husbands thither. Yet notwithstanding their having been anciently in such high repute for their wisdom and supposed spirit of prophecy, and their continuing such faithful and tender helpmates to their husbands, they sunk in time so low in their esteem, that, according to the old Saxon law, he that hurt or killed a woman was to pay but half the fine that he should have done, if he had hurt or killed a man.

31 Their funerals.

There is scarcely any one thing in which the Germans, though so nearly allied in most of their other customs to the Gauls, were yet more opposite to them than in their funerals. Those of the latter were performed with great pomp and profusion; those of the former were done with the same plainness and simplicity which they observed in all other things; the only grandeur they affected in them was, to burn the bodies of their great men with some peculiar kinds of wood; but then the funeral pile was neither adorned with the clothes and other fine furniture of the deceased, nor perfumed with fragrant herbs and gums: each man's armour, that is, his sword, shield, and spear, were flung into it, and sometimes his riding horse. The Danes, indeed, flung into the funeral pile of a prince, gold, silver, and other precious things, which the chief mourners, who walked in a gloomy guise round the fire, exhorted the bystanders to fling liberally into it in honour of the deceased. They afterwards deposited their ashes in urns, like the Gauls, Romans, and other nations; as it plainly appears, from the vast numbers which have been dug up all over the country, as well as from the sundry dissertations which have been written upon them by several learned moderns of that nation. One thing we may observe, in general, that whatever sacrifices they offered for their dead, whatever presents they made to them at their funerals, and whatever other superstitious rites they might perform at them, all was done in consequence of those excellent notions which their ancient religion had taught them, the immortality of the soul, and the bliss or misery of a future life.

32 The belief of a future state.

It is impossible, indeed, as they did not commit any thing to writing till very lately, and as none of the ancient writers have given us any account of it, to guess how soon the belief of their great Odin, and his paradise, was received among them. It may, for aught we know, have been older than the times of Tacitus, and he have known nothing of it, by reason of their scrupulous care in concealing their religion from strangers: but as they conveyed their doctrines to posterity by songs and poems, and most of the northern poets tell us that they have drawn their intelligence from those very poems which were still preserved among them; we may rightly enough suppose, that whatever doctrines are contained in them, were formerly professed by the generality of the nation, especially since we find their ancient practice so exactly conformable to it. Thus, since the surest road to this paradise was, to excel in martial deeds, and to die intrepidly in the field of battle; and since none were excluded from it but base cowards, and betrayers of their country; it is natural to think, that the signal and excessive bravery of the Germans flowed from this ancient belief of theirs: and, if their females were so brave and faithful as not only to share with their husbands all the dangers and fatigues of war, but at length to follow them by a voluntary death, into the other world; it can hardly be attributed to any thing else but a strong persuasion of their being admitted to live with them in that place of bliss. This belief, therefore, whether received originally from the old Celtes, or afterwards taught them by the since deified Odin, seems, from their general practice, to have been universally received by all the Germans, though they might differ one from another in their notions of that future life.

The notion of a future happiness obtained by martial exploits, especially by dying sword in hand, made them bewail the fate of those who lived to an old age, as dishonourable here, and hopeless hereafter: upon which account, they had a barbarous way of sending them into the other world, willing or not willing. And this custom lasted several ages after their receiving Christianity, especially among the Prussians and Venidi; the former of whom, it seems, despatched by a quick death, not only their children, the sick, servants, &c. but even their parents, and sometimes themselves: and among the latter we have instances of this horrid parricide being practised even in the beginning of the 14th century. All that need be added is, that, if those persons, thus supposed to have lived long enough, either desired to be put to death, or at least seemed cheerfully to submit to what they knew they could not avoid, their exit was commonly preceded with a fast, and their funeral with a feast; but if they endeavoured to shun it, as it sometimes happened, both ceremonies were performed with the deepest mourning. In the former, they rejoiced at their deliverance, and being admitted into bliss; in the latter, they bewailed their cowardly excluding themselves from it. Much the same thing was done towards those wives who betrayed a backwardness to follow their dead husbands.

33 Remarkable for drinking to excess.

We must likewise observe, that, in these funerals, as well as in all their other feasts, they were famed for drinking to excess; and one may say of them, above all the other descendants of the ancient Celtes, that their hospitality, banquets, &c. consisted much more in the quantity of strong liquors, than in the elegance of eating. Beer and strong mead, which were their natural drink, were looked upon as the chief promoters of health, strength, fertility, and bravery; upon which account, they made no scruple to indulge themselves to the

Germany.

34 Character of the modern Germans.

the utmost in them, not only in their feasts, and especially before an engagement, but even in their common meals.

The modern Germans in their persons are tall and strong built. The ladies have generally fine complexions; and some of them, especially in Saxony, have all the delicacy of features and shape that are so bewitching in a certain island of Europe.

Both men and women affect rich dresses, which in fashion are the same as in France and England, but the better sort of men are excessively fond of gold and silver lace, especially if they are in the army. The ladies at the principal courts differ not much in their dress from the French and English, only they are not so excessively fond of paint as the former. At some courts they appear in rich furs; and all of them are loaded with jewels, if they can obtain them. The female part of the burghers families, in many German towns, dress in a very different manner, and some of them inconceivably fantastic, as may be seen in many prints published in books of travels; but in this respect they are gradually reforming, and many of them make quite a different appearance in their dress from what they did 30 or 40 years ago. As to the peasantry and labourers, they dress as in other parts of Europe, according to their employments, conveniency, and opulence. In Westphalia, and most other parts of Germany, they sleep between two feather beds, or rather the upper one of down, with sheets stretched to them, which by use becomes a very comfortable practice. The most unhappy part of the Germans are the tenants of little needy princes, who squeeze them to keep up their own grandeur; but, in general, the circumstances of the common people are far preferable to those of the French.

The Germans are naturally a frank, honest, hospitable people, free from artifice and disguise. The higher orders are ridiculously proud of titles, ancestry, and show. The Germans, in general, are thought to want animation, as their persons promise more vigour and activity than they commonly exert even in the field of battle. But when commanded by able generals, especially the Italians, such as Montecuculi and Prince Eugene, they have done great things, both against the Turks and the French. The Imperial arms have seldom made any remarkable figure against either of those two nations, or against the Swedes or Spaniards, when commanded by German generals. This possibly might be owing to the arbitrary obstinacy of the court of Vienna; for in many wars the Austrians have exhibited prodigies of military valour and genius.

Industry, application, and perseverance, are the great characteristics of the German nation, especially the mechanical part of it. Their works of art would be incredible were they not visible, especially in watch and clockmaking, jewellery, turnery, sculpture, drawing, painting, and certain kinds of architecture. The Germans have been charged with intemperance in eating and drinking; and perhaps not unjustly, owing to the vast plenty of their country in wine and provisions of every kind. But those practices seem now to be wearing out. At the greatest tables, though the guests drink pretty freely during dinner, yet the repast is commonly finished by coffee, after three or four public toasts have been drank. But no people have more feasting at marriages, funerals, and birth-days.

The German nobility are generally men of so much honour, that a sharper in other countries, especially in England, meets with more credit if he pretends to be a German, than of any other nation.

The merchants and tradesmen are very civil and obliging. All the sons of noblemen inherit their father's titles, which greatly perplexes the heralds and genealogists of that country. This perhaps is one of the reasons why the German husbands are not quite so complaisant as they ought otherwise to be to their ladies, who are not entitled to any pre-eminence at the table; nor indeed do they seem to affect it, being far from either ambition or loquacity, though they are said to be somewhat too fond of gaming. From what has been premised, it may easily be conceived, that many of the German nobility, having no other hereditary estate than a high sounding title, easily enter into their armies, and those of other sovereigns. Their fondness for title is attended with many other inconveniencies. Their princes think that the cultivation of their lands, though it may treble their revenue, is below their attention; and that, as they are a species of beings superior to labourers of every kind, they would demean themselves in being concerned in the improvement of their grounds.

The domestic diversions of the Germans are the same as in England; billiards, cards, dice, fencing, dancing, and the like. In summer, people of fashion repair to places of public resort, and drink the waters. As to their field diversions, besides their favourite one of hunting, they have bull and bear baiting, and the like. The inhabitants of Vienna live luxuriously, a great part of their time being spent in feasting and carousing; and in winter, when the several branches of the Danube are frozen over, and the ground covered with snow, the ladies take their recreation in sledges of different shapes, such as griffins, tygers, swans, scallop-shells, &c. Here the lady sits, dressed in velvet, lined with rich furs, and adorned with laces and jewels, having on her head a velvet cap; and the sledge is drawn by one horse, stag, or other creature, set off with plumes of feathers, ribands, and bells. As this diversion is taken chiefly in the night-time, servants ride before the sledge with torches, and a gentleman sitting on the sledge behind guides the horse. 35 Amusements.

The Reformation first spread in Germany to most advantage; and since the religious peace of 1555, there have been established the Roman Catholic, prevailing mostly in the south; the Lutheran in the north; and the Calvinist, called also the *Reformed*, near the Rhine. Civil wars considerably deranged this settlement: it was, however, established by the celebrated peace of Westphalia, that the religion of the Seven States should remain as in 1624. The Romish superior clergy consist of 8 archbishops, 40 bishops, and many abbots. The Protestant clergy are governed by consistories under the sovereign of each state. The *Corpus Catholicorum* is under the direction of the archbishop, elector of Mentz; and the *Corpus Evangelicorum*, or Protestants, under the elector of Saxony; who have the care of the public concerns of their respective bodies. 36 Religion and learning.

Literature

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Literature is in a very advanced state throughout almost all Germany, but particularly in the Protestant states. It is but about half a century since the German language has been purified and cultivated; since which various works of taste and elegance, as well as superior productions in the different walks of science, have appeared in it. There are at present 19 universities in Germany, with about 850 professors; besides a number of literary societies and academic institutions: and education in general is particularly attended to even in the very lowest ranks.

A detailed account of the present statistical and political condition of Germany will be found in the article GERMANY, SUPPLEMENT.

GERMEN, the seed bud; defined by Linnæus to be the base of the pistillum, which contains the rudiments of the seed; and, in progress of vegetation, swells and becomes the seed vessel.

In assimilating the vegetable and animal kingdoms, Linnæus denominates the seed bud the *ovarium* or *uterus* of plants; and affirms its existence to be chiefly at the time of the dispersion of the male dust by the antheræ; as, after its impregnation, it becomes a seed vessel. See BOTANY.

GERMEN, by Pliny and the ancient botanists, is used to signify a bud containing the rudiments of the leaves. See GEMMA.

GERMINATION, among botanists, comprehends the precise time which the seeds take to rise after they have been committed to the soil.—The different species of seeds are longer or shorter in rising according to the degree of heat which is proper to each. Millet, wheat, and several of the grasses, rise in one day; blite, spinach, beans, mustard, kidney beans, turnips, and rocket, in three days; lettuce and dill, in four; cucumber, gourd, melon, and cress, in five; radish and beet, in six; barley, in seven; orach, in eight; purslain, in nine; cabbage, in ten; hyssop, in thirty; parsley, in forty or fifty days; peach, almond, walnut, chesnut, peony, horned poppy, hypecoum, and ranunculus falcatus, in one year; rose bush, cornel tree, hawthorn, medlar, and hazel nut, in two. The seeds of some species of orchis, and of some liliaceous plants, never rise at all. Of seeds, some require to be sowed almost as soon as they are ripe, otherwise they will not sprout or germinate. Of this kind are the seeds of coffee and fraxinella. Others, particularly those of the pea-bloom flowers, preserve their germinating faculty for a series of years. Mr Adanson asserts, that the sensitive plant retains that virtue for 30 or 40 years.

Air and water are the agents of germination. The humidity of the air alone makes several seeds to rise that are exposed to it. Seeds too are observed to rise in water, without the intervention of earth; but water without air is insufficient. Mr Homberg's experiments on this head are decisive. He put several seeds under the exhausted receiver of an air pump, with a view to establish something certain on the causes of germination. Some of them did not rise at all; and the greatest part of those which did, made very weak and feeble productions. Thus it is for want of air that seeds which are buried at a very great depth in the earth, either thrive but indifferently, or do not rise at all. They frequently preserve, however, their germinating virtue for many years within the bowels of the earth; and it is not unusual, upon a piece of ground being newly dug to a considerable depth, to observe it soon after covered with several plants, which had not been seen there in the memory of man. Were this precaution frequently repeated, it would doubtless be the means of recovering certain species of plants which are regarded as lost; or which perhaps, never coming to the knowledge of botanists, might hence appear the result of a new creation.

GERONTES, in antiquity, a kind of judges, or magistrates, in ancient Sparta, answering to what the Areopagites were at Athens. See AREOPAGUS.

The word is formed of the Greek γερων, which signifies "old man." Whence also the words *gerontic*, something belonging to an old man; and *Geronicon*, a famous book among the modern Greeks, containing the lives of the ancient monks. The senate of gerontes was called *gerusia*, that is, assembly or council of old men.

The gerontes were originally instituted by Lycurgus: their number, according to some, was 28; and, according to others, 32. They governed in conjunction with the king, whose authority they were intended to balance, and to watch over the interests of the people. Polybius defines their office in few words, when he says, *per ipsos, et cum ipsis, omnia administrari.* None were to be admitted into this office under 60 years of age, and they held it for life. They were succeeded by the ephori.

GEROPOGON, a genus of plants belonging to the syngenesia class, and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

GERRETZ. See REMBRANDT.

GERS, a department in the south-west of France Its surface is in general hilly but fertile, and abounds more in pasture soil than in arable land. In 1815 it contained 286,500 inhabitants, on an area of 2620 square miles. Auch is the chief town.

GERVAISE, or GERVASE, of Tilbury, a famous English writer of the 13th century; thus named from his being born at Tilbury on the Thames. He was nephew to Henry II. king of England; and was in great credit with Otho IV. emperor of Germany, to whom he dedicated a Description of the World, and a Chronicle. He also composed a History of England, that of the Holy Land, and other works.

GERUND, in *Grammar*, a verbal noun of the neuter gender, partaking of the nature of a participle, declinable only in the singular number, through all the cases except the vocative; as nom. *amandum*, gen. *amandi*, dat. *amando*, accus. *amandum*, abl. *amando*. The word is formed of the Latin *gerundivus*, and that from the verb *gerere*, "to bear."

The *gerund* expresses not only the *time*, but also the *manner* of an action; as, "he fell in running post."—It differs from the participle, in that it expresses the *time*, which

which the participle does not; and from the tense properly so called, in that it expresses the *manner*, which the tense does not. See GRAMMAR.

GERUNDA, in *Ancient Geography*, a town of the Ausetani, in the Hither Spain, on the south or right side of the river Sambroca. *Gerundenses*, the people. Now *Gironne* in Catalonia, on the Ter. E. Long. 2. 35. N. Lat. 42.

GESNER, CONRAD, a celebrated physician and naturalist, was born at Zurich in 1516. Having finished his studies in France, he travelled into Italy, and taught medicine and philosophy in his own country with extraordinary reputation. He was acquainted with the languages; and excelled so much in natural history, that he was surnamed the *Pliny of Germany*. He died in 1564, leaving many works behind him; the principal of which are, 1. A history of animals, plants, and fossils; 2. *Bibliotheca Universalis*. A Greek and Latin lexicon. This author is by Boerhaave emphatically styled *Monstrum Eruditionis*, "a prodigy of learning." Those indeed (as Mr Coxe observes in his Letters on Switzerland) "who are conversant with the works of this great scholar and naturalist, cannot repress their wonder and admiration at the amplitude of his knowledge in every species of erudition, and the variety of his discoveries in natural history, which was his peculiar delight. Their wonder and admiration is still further augmented, when they consider the gross ignorance of the age which he helped to enlighten, and the scanty succours he possessed to aid him in thus extending the bounds of knowledge; that he composed his works, and made those discoveries which would have done honour to the most enlightened period, under the complicated evils of poverty, sickness, and domestic uneasiness."

GESNER, *Solomon*, the celebrated author of the death of Abel and many other admired works in the German language, was born at Zurich in the year 1730. In his early years he showed very few signs of superior abilities; and his progress in the rudiments of education was so slow, that his master gave him up as incapable of any greater attainments than writing and the four first rules of arithmetic. Upon this he was placed under a clergyman in the neighbourhood, a relation of his father's, and who showed himself better acquainted with the art of discovering the natural inclinations of his pupils. This gentleman often carried young Gesner with him into the fields, where he made him observe the beauties of nature; and finding that he took greater pleasure in such lessons, and seemed to listen to them with peculiar attention, he occasionally repeated some of the most striking passages of the ancient authors, who have written on these subjects, in the most agreeable and pleasing manner. By this ingenious artifice, the mind of young Gesner began to open, and its powers to expand; and it is, perhaps, owing to this circumstance, that he became so fond of the language of Virgil and Theocritus. When he arrived at a proper age to think of pursuing some line of business, Mr Gesner made choice of that of a bookseller, which was the profession of his father, and in some measure of his family. Of five houses at Zurich in the printing and bookselling business, two were occupied by Gesners: one belonged to two brothers of that name; and the other, that in which our poet had a share, was known by the firm of *Orel, Gesner, and Company*. It was known also by the extent of its correspondence, and by the choice and elegance of the works which it gave to the public.

Though Mr Gesner was a bookseller, he did not, however, damp his genius, by submitting to the drudgery of business. He indulged himself freely in pursuing his favourite object, and his partners never envied him that time which he devoted to meditation and to study. In 1752, he made a tour through Germany, not so much for the purpose of extending his commerce, as to see and be acquainted with those authors who have done honour to their country. The following circumstance, which occurred during this tour, deserves to be mentioned, as it is strikingly characteristic of that timidity which often accompanies true genius. When Mr Gesner was at Berlin, he was admitted into a literary society, of which Gleim and Lessing were members. Each of the authors who composed it used to read in turn some pieces of their own composition, and Mr Genser was very desirous of submitting to these able critics a small work, which was his first attempt; but was far from resembling those poets, whom Horace and other satirists have ridiculed, and who stun every one they meet by reciting their verses before them. As each of the members had done reading, Gesner was observed to move his hand with a kind of tremor towards his pocket, and to draw it back again without the manuscript which he ought to have produced. Having not as yet published any thing, none of the company could guess the cause of a motion which his modesty prevented him from explaining. The work which he had not the courage to show, was his small poem, entitled *Night*, which he published on his return to Zurich in 1753. It was considered as an original, of which no model is to be found among the moderns; but in the opinion of the author, it was only a piece of imaginary painting, or, to use an expression of his own, in one of his letters to Mr Huber who has translated his works, "A caricature composed in the moments of folly or intoxication." In this little poem he has introduced a short episode on the origin of the glow-worm, containing a poetical explanation of this natural phosphorus, which has all the beauty of Ovid's Metamorphoses without their prolixity. The success of this essay emboldened the too timid muse of our young bookseller, and he published a pastoral romance, called *Daphnis*, in three cantos. The applause that was deservedly bestowed upon this performance induced the author to publish, some time after, his Idylls and some other rural poems in imitation of those of Theocritus. Pastoral poetry, which at this time was little known in Germany but by translations from foreign poets, began to find many partizans, and to be preferred to every other kind. Desirous, therefore, of tracing out a new path for himself, our poet thought that he could not do a more acceptable service to his countrymen, than to paint the felicity of innocence and rural life, and the tender emotions of love and gratitude. The only author worthy of notice who had preceded Mr Gesner in this career, was Mr Rost of Leipsic, whose pastoral poems appeared for the first time in 1744. This writer polished the language of the German shepherds; he had address enough to unite spirit and simplicity in a kind

of

Gesner.

of writing which appears insipid without the former, and which becomes unnatural and disgusting if it is too abundant. He sometimes throws a delicate veil over those images which are deficient in decency, but it is to be regretted that it is often too light. Such was the antagonist against whom Gesner had to contend. Our poet, however, pursued a different course. Instead of placing, like Rost, his scenes in modern times, he goes back with Theocritus to the golden age, that happy age which we are fond of reviewing when our passions are calm, and when freed from those anxious cares which hurry us beyond ourselves, we contemplate amidst tranquillity the beauties and fertility of the country. The characters of Gesner's Idylls, therefore, are taken from those societies which exist no longer but in the remembrance, or rather the imagination. His shepherds are fathers, children, and husbands, who blush not at these titles so dear to nature, and to whom generosity, beneficence, and respect for the Deity are sentiments no less familiar than love. These Idylls were the principal and favourite object of his pursuit, and that part of his works which acquired him the greatest reputation, especially among his countrymen. His death of Abel, which is well known, was published for the first time in 1758. It is written, like the rest of his pieces, in poetical prose; and was so much sought after, that it went through no less than three editions in the space of a year, without speaking of the spurious ones which appeared in Holland, at Berlin, and in France. The French edition was followed by several others. One came out in Italian; another in the Dutch language; a fourth in the Danish: and lastly, two in English, one of them in prose and the other in verse. Among the pieces which Mr Gesner published after the death of Abel was his First Navigator, a poem in three cantos, which many people in Germany consider as his masterpiece. He made an attempt also in the pastoral drama, but not with the same success as in other kinds of rural poetry. He produced likewise, in the same style, Evander and Alcimne, in three acts; and Erastus, a small piece of one act, which was represented with some applause in several societies, both at Leipsic and Vienna.

But though poetry was Gesner's darling pursuit, and though he enriched the literature of his country with works which will render his name immortal, he did not confine himself to one manner of imitating nature; he in turns took up the pencil and the pen, and his active genius equally directed them both. In his infancy he had received a few lessons in drawing, and he had afterwards pursued his study, but without any intention of becoming an artist. At the age of thirty he felt that violent desire, which may be considered as the voice of genius; and this was in some measure excited by the sight of a beautiful collection formed by Mr Heidegger, whose daughter he had married. To please his father-in-law, he studied this treasure, composed principally of the best pieces of the Flemish school; and to this new taste he had almost sacrificed every other. Mr Gesner at first ventured only to delineate some decorations for the frontispieces of curious books printed in his office; but by little and little he had the courage to make other attempts. In 1765, he published 10 landscapes etched and engraved by himself, and dedicated them to his friend Mr Watlet. Mr Gesner owed him this mark of respect for the care which he took to ornament with beautiful vignettes Mr Huber's translation of his Idylls. Twelve other pieces appeared in 1769; and after these attempts, Mr Gesner executed ornaments for many works which came from his presses, among which were his own works, a German translation of Swift, and several others.

Were we to judge from Mr Gesner's enthusiasm for his favourite pursuits, and from the time and attention which he bestowed upon them, we should be apt to conclude, that he found little leisure for discharging his duty as a citizen. The contrary, however, was the case, for he passed almost the half of his life in the first employments of the state. In 1765 he was called to the grand council, in 1767 to the lesser. In 1768 he was appointed bailiff of Elibach, that of the four guards in 1776, and in 1781 superintendant of waters, which office in 1787 was continued to him for six years. In all these stations Mr Gesner discharged his duty with the most scrupulous fidelity; and died of a paralytical disorder, lamented by his countrymen and by those who had the pleasure of his acquaintance, on the 2d of March 1788, at the age of 56.

As a pastoral poet, Gesner undoubtedly is entitled to a very distinguished rank: and we may justly say, that if he has been equalled by any, he has been excelled by none. It is commonly believed, that pastoral poetry is very limited and confined; but those who read the works of Gesner will be convinced, that it is susceptible of much variety when treated of by the hand of a master. His pastoral romance of Daphnis is not inferior in natural simplicity to the celebrated work of Longus; but it surpasses it far in variety of images and incident. Erastus and Evander are instructive and interesting poems, on account of the contrast between the world and nature which reigns throughout them; and his First Navigator unites the mildest philosophy to all the splendour and imagery of Fairy Land. If we analyze his dramatic poems, we shall find in them interesting fictions, characters well delineated, and situations replete with novelty. His language is that of the Graces, and the chastest ears might listen to the love which he has created. If he has sometimes the humour of Sterne and Fontaine, it is without their licentiousness. The severest taste can find in his writings, no lacuna to supply, no phrase deserving reprehension, nor could a more ingenious choice of expressions be substituted in the room of those which he has adopted.—Gesner's character as a man, appears to be no less amiable. In whatever point of view we consider him, whether as a husband, a father, a friend, a magistrate, or a citizen, his virtues are equally conspicuous. He was naturally of a melancholy turn, but he was no enemy to rational and well-timed mirth; while the mildness and affability of his temper rendered his company always engaging, and endeared him to those who had the pleasure of his acquaintance. Possessed of that nobleness of sentiment, united with great modesty, which is the usual attendant of true genius, he was simple in his external appearance, as well as in his conversation. His language was lively and animated; but his reserve before strangers resembled timidity, and

and it was only in the presence of those with whom he was acquainted, that his real character appeared in its full lustre.

Mr Gesner's reputation and virtues were known even to the remotest parts of Europe. The empress of Russia Catharine II. presented him with a gold medal as a mark of her esteem. Strangers of all nations gave him no less flattering testimonies of their admiration; and travellers thought they had seen only the half of Switzerland, if they had not been in the company of Gesner, or procured some of his landscapes or drawings. In this last way he had acquired so much reputation, that he was ranked among the best artists of Germany; and Mr Fuseli, his countryman, who was himself a painter, in the preface to the third volume of the new edition which he published of his 'Historical essay on the painters, engravers, architects, and sculptors, who have done honour to Switzerland,' gives a distinguished place to Mr Gesner, though then living.

GESNERIA, a genus of plants belonging to the didynamia class, and in the natural method ranking under the 40th order, *Personatæ*. See BOTANY *Index*.

GESSORIACUM, in *Ancient Geography*, a port and station for ships of the Morini in Belgica. In Cæsar's time, according to Dio, there was no town; but Florus speaks of it as one: and the Gessoriacenses Muri are mentioned by Eumenius in his panegyric. The author of Tabula Theodosiana, commonly called *Peutinger's map*, says expressly, that Gessoriacum was in his time called *Bononia*. Now *Boulogne* in Picardy. E. Long. 1. 30. N. Lat. 50. 40.

GESTATION, among physicians. See PREGNANCY.

GESTRICIA, a province of Sweden, bounded by Helsingia on the north, by the Bothnic gulf on the east, by Upland on the south, and by Dalecarlia on the west.

GESTURE, a motion of the body, intended to signify some idea or passion of the mind. It consists principally in the action of the hands and face; and may be defined, a suitable conformity of the motions of the countenance, and of several parts of the body, in speaking, to the subject matter of the discourse. See DECLAMATION and ORATORY.

GETA, SEPTIMUS, a son of the emperor Severus, brother to Caracalla. In the eighth year of his age, he was moved with compassion at the fate of some of the partizans of Niger and Albinus who were to be executed, and his father struck with his humanity retracted the sentence. After Severus's death he reigned at Rome conjointly with his brother; but Caracalla, who envied his virtues and was jealous of his popularity, ordered him to be poisoned; and when this could not be effected, he murdered him in the arms of his mother Julia, who in the attempt of defending the fatal blows from his body received a wound in her arm, from the hand of her son, A. D. 212. Geta had not yet reached the 23d year of his age, and the Romans had reason to lament the death of so virtuous a prince, while they groaned under the cruelties and oppression of Caracalla.

GETHIN, LADY GRACE, an English lady of uncommon parts, was the daughter of Sir George Norton of Abbots Leigh in Somersetshire, and born in the year 1676. She had all the advantages of a liberal education; and became the wife of Sir Richard Gethin, of Gethin Grott in Ireland. She was mistress of great accomplishments, natural and acquired, but did not live long enough to display them to the world; for she died in the 21st year of her age. She was buried in Westminster abbey, where a beautiful monument with an inscription is erected over her; and, for perpetuating her memory, provision was made for a sermon to be preached in Westminster abbey yearly, on Ash Wednesday for ever. She wrote, and left behind her, in loose papers, a work, which, soon after her death, was methodized, and published under the title of "*Reliquiæ Gethinionæ*; or, Some remains of the most ingenious and excellent lady, Grace, lady Gethin, lately deceased. Being a collection of choice discourses, pleasant apophthegms, and witty sentences. Written by her, for the most part, by way of essay, and at spare hours." Lond. 1700, 4to; with her picture before it.

GETHSEMANE, in *Ancient Geography*, a village in the mount of Olives, whither Jesus Christ sometimes retreated in the night time. It was in a garden belonging to this village that he suffered the agony in which he sweated drops of blood; and here he was arrested by Judas and the rest who were conducted by this traitor. The place is by Maundrel described as an even plot of ground, not above 57 yards square, lying between the foot of Mount Olivet and the brook Cedron.

GETHYLLIS, a genus of plants belonging to the dodecandria class, and in the natural method ranking under the ninth order *Spathaceæ*. See BOTANY *Index*.

GEUM, AVENS, or *Herb Bennet*, a genus of plants belonging to the icosandria class, and in the natural method ranking under the 35th order, *Senticosæ*. See BOTANY *Index*.

GHENT, a city of the Austrian Netherlands, capital of the province of Flanders. It is seated on four navigable rivers, the Scheldt, the Lys, the Lieve, and the Moere, which run through it, and divide it into canals. These form 26 little isles, over which there are 300 bridges: among which there is one remarkable for a statue of brass of a young man, who was obliged to cut off his father's head; but as he was going to strike, the blade flew into the air, and the hilt remained in his hand, upon which they were both pardoned. There is a picture of the whole transaction in the townhouse. Ghent is surrounded with walls and other fortifications, and is tolerably strong for a place of its circumference. But all the ground within the walls is not built upon. The streets are large and well paved, the market places spacious, and the houses built with brick. But the Friday's market place is the largest, and is remarkable for the statue of Charles V. which stands upon a pedestal in the imperial habit. That of Cortere is remarkable for a fine walk under several rows of trees. In 1737 a fine opera house was built here, and a guard house for the garrison. Near the town is a very high tower, with a handsome clock and chimes. The great bell weighs 11,000 pounds.

This town is famous for the pacification signed here, in 1526, for settling the tranquillity of the Seventeen Provinces, which was afterwards confirmed by the king of Spain. It was taken by Louis XIV. in 1678, who

who afterwards restored it. The French took possession of it again after the death of Charles II. of Spain. In 1706, it was taken by the duke of Marlborough; and by the French in 1708; but it was retaken the same year. Last of all, the French took it by surprise after the battle of Fontenoy; but at the peace of Aix-la-Chapelle, it was rendered back. It was also taken by the French in 1794; and was restored to the Netherlands in 1814. This is the birth-place of John of Gaunt. It is very well seated for trade, on account of its rivers and canals. It has linen, woollen, and silk manufactures. The number of inhabitants is abont 61,000. E. Long. 3. 50. N. Lat. 51. 14.

GHOST, an apparition, or spirit of a person deceased.

The ancients supposed every man to be possessed of three different ghosts, which after the dissolution of the human body were differently disposed of. These three ghosts were distinguished by the names of *Manes*, *Spiritus*, *Umbra*. The *manes*, they fancied, went down into the infernal region; the *spiritus* ascended to the skies; and the *umbra* hovered about the tomb, as being unwilling to quit its old connexions. Thus Dido (Virg. Æn. iv. 384.) threatens Æneas after death that she will haunt him with her umbra, whilst her manes rejoices in his torments below. This idea of a threefold soul is very clearly expressed in these lines, which have been attributed to Ovid.

Bis duo sunt homini: MANES, CARO, SPIRITUS, UMBRA:
Quatuor ista loci bis duo suscipiunt.
Terra tegit CARNEM, *tumulum circumvolat* UMBRA,
Orcus habet MANES, SPIRITUS *astra petit.*

The most striking outlines of the popular superstitions respecting ghosts among us, are thus humorously collected by Captain Grose in his Provincial Glossary: "A ghost is supposed to be the spirit of a person deceased, who is either commissioned to return for some special errand, such as the discovery of a murder, to procure restitution of lands or money unjustly withheld from an orphan or widow—or, having committed some injustice whilst living, cannot rest till that is redressed. Sometimes the occasion of spirits revisiting this world, is to inform their heir in what secret place, or private drawer in an old trunk, they had hidden the title deeds of the estate; or where, in troublesome times, they buried their money or plate. Some ghosts of murdered persons, whose bodies have been secretly buried, cannot be at ease till their bones have been taken up, and deposited in consecrated ground with all the rites of Christian burial.

"Sometimes ghosts appear in consequence of an agreement made, whilst living, with some particular friend, that he who first died should appear to the survivor.

"Glanvil tells us of the ghost of a person who had lived but a disorderly kind of life, for which it was condemned to wander up and down the earth, in the company of evil spirits, till the day of judgment.

"In most of the relations of ghosts, they are supposed to be mere aerial beings, without substance, and that they can pass through walls and other solid bodies at pleasure. A particular instance of this is given, in relation the 27th, in Glanvil's collection, where one David Hunter, neat-herd to the bishop of Down and Connor was for a long time haunted by the apparition of an old woman, whom he was by a secret impulse obliged to follow whenever she appeared, which he says he did for a considerable time, even if in bed with his wife: and because his wife could not hold him in his bed, she would go too, and walk after him till day, though she saw nothing; but his little dog was so well acquainted with the apparition, that he would follow it as well as his master. If a tree stood in her walk, he observed her always to go through it. Notwithstanding this seeming immateriality, this very ghost was not without some substance; for, having performed her errand, she desired Hunter to lift her from the ground; in the doing of which, he says, she felt just like a bag of feathers. We sometimes also read of ghosts striking violent blows; and that, if not made way for, they overturn all impediments, like a furious whirlwind. Glanvil mentions an instance of this, in relation 17th, of a Dutch lieutenant who had the faculty of seeing ghosts; and who being prevented making way for one which he mentioned to some friends as coming towards them, was, with his companions, violently thrown down, and sorely bruised. We further learn, by relation 16th, that the hand of a ghost is 'as cold as a clod.'

"The usual time at which ghosts make their appearance is midnight, and seldom before it is dark: though some audacious spirits have been said to appear even by day light: but of this there are few instances, and those mostly ghosts who have been laid, perhaps in the Red sea (of which more hereafter), and whose times of confinement were expired: these, like felons confined to the lighters, are said to return more troublesome and daring than before. No ghosts can appear on Christmas eve; this Shakespeare has put into the mouth of one of his characters in Hamlet.

"Ghosts commonly appear in the same dress they usually wore whilst living, though they are sometimes clothed all in white; but that is chiefly the churchyard ghosts, who have no particular business, but seem to appear *pro bono publico*, or to scare drunken rustics from tumbling over their graves.

"I cannot learn that ghosts carry tapers in their hands, as they are sometimes depicted, though the room in which they appear, if without fire or candle, is frequently said to be as light as day. Dragging chains is not the fashion of English ghosts; chains and black vestments being chiefly the accoutrements of foreign spectres seen in arbitrary governments: dead or alive, English spirits are free. One instance, however, of an English ghost dressed in black is found in the celebrated ballad of William and Margaret, in the following lines:

And clay cold was her lily hand
That held her *sable shroud.*

This, however, may be considered as a poetical license, used, in all likelihood, for the sake of the opposition of *lily* to *sable*.

"If, during the time of an apparition, there is a lighted candle in the room, it will burn extremely blue: this is so universally acknowledged that many eminent philosophers have busied themselves in accounting for it, without once doubting the truth of the fact. Dogs, too, have the faculty of seeing spirits, as is instanced in

Ghost.

David Hunter's relation above quoted; but in that case they usually show signs of terror, by whining and creeping to their master for protection; and it is generally supposed that they often see things of this nature when their owner cannot; there being some persons, particularly those born on a Christmas eve, who cannot see spirits.

"The coming of a spirit is announced some time before its appearance, by a variety of loud and dreadful noises; sometimes rattling in the old hall like a coach and six, and rumbling up and down the staircase like the trundling of bowls or cannon balls. At length the door flies open, and the spectre stalks slowly up to the bed's foot, and opening the curtains, looks steadfastly at the person in bed by whom it is seen; a ghost being very rarely visible to more than one person, although there are several in company. It is here necessary to observe, that it has been universally found by experience, as well as affirmed by diverse apparitions themselves, that a ghost has not the power to speak till it has been first spoken to; so that, notwithstanding the urgency of the business on which it may come, every thing must stand still till the person visited can find sufficient courage to speak to it: an event that sometimes does not take place for many years. It has not been found that female ghosts are more loquacious than those of the male sex, both being equally restrained by this law.

"The mode of addressing a ghost is by commanding it, in the name of the Three Persons of the Trinity, to tell you who it is, and what is its business; this it may be necessary to repeat three times; after which it will, in a low and hollow voice, declare its satisfaction at being spoken to, and desire the party addressing it not to be afraid, for it will do him no harm. This being premised, it commonly enters into its narrative; which being completed, and its request or commands given, with injunctions that they be immediately executed, it vanishes away, frequently in a flash of light; in which case, some ghosts have been so considerate as to desire the party to whom they appeared to shut their eyes: sometimes its departure is attended with delightful music. During the narration of its business, a ghost must by no means be interrupted by questions of any kind; so doing is extremely dangerous: if any doubts arise, they must be stated after the spirit has done its tale. Questions respecting its state, or the state of any of their former acquaintance, are offensive, and not often answered; spirits perhaps being restrained from divulging the secrets of their prison house. Occasionally spirits will even condescend to talk on common occurrences, as is instanced by Glanvil in the apparition of Major George Sydenham to Captain William Dyke, relation 10th, wherein the major reproved the captain for suffering a sword he had given him to grow rusty: saying, 'Captain, captain, this sword did not use to be kept after this manner when it was mine.' This attention to the state of arms, was a remnant of the major's professional duty when living.

"It is somewhat remarkable that ghosts do not go about their business like the persons of this world. In cases of murder, a ghost, instead of going to the next justice of the peace, and laying its information, or to the nearest relation of the person murdered, appears to some poor labourer who knows none of the parties, draws the curtains of some decrepit nurse or alms woman, or hovers about the place where his body is deposited. The same circuitous mode is pursued with respect to redressing injured orphans or widows; when it seems as if the shortest and most certain way would be, to go to the person guilty of the injustice, and haunt him continually till he be terrified into a restitution. Nor is the pointing out lost writings generally managed in a more summary way; the ghost commonly applying to a third person ignorant of the whole affair, and a stranger to all concerned. But it is presumptuous to scrutinize too far into these matters: ghosts have undoubtedly forms and customs peculiar to themselves.

"If after the first appearance, the persons employed neglect, or are prevented from, performing the message or business committed to their management, the ghost appears continually to them, at first with a discontented, next an angry, and at length with a furious, countenance, threatening to tear them in pieces if the matter is not forthwith executed; sometimes terrifying them, as in Glanvil's relation 26th, by appearing in many formidable shapes, and sometimes even striking them a violent blow. Of blows given by ghosts there are many instances, and some wherein they have been followed with an incurable lameness.

"It should have been observed, that ghosts, in delivering their commissions, in order to ensure belief, communicate to the persons employed some secret, known only to the parties concerned and themselves, the relation of which always produces the effect intended. The business being completed, ghosts appear with a cheerful countenance, saying they shall now be at rest, and will never more disturb any one; and, thanking their agents, by way of reward communicate to them something relative to themselves, which they will never reveal.

"Sometimes ghosts appear, and disturb a house, without deigning to give any reason for so doing: with these, the shortest and only way is to exorcise, and eject them; or, as the vulgar term is, lay them. For this purpose there must be two or three clergymen, and the ceremony must be performed in Latin; a language that strikes the most audacious ghost with terror. A ghost may be laid for any term less than 100 years, and in any place or body, full or empty; as, a solid oak—the pommel of a sword—a barrel of beer, if a yeoman or simple gentleman—or a pipe of wine, if an esquire or a justice. But of all places the most common, and what a ghost least likes, is the Red sea; it being related, in many instances, that ghosts have most earnestly besought the exorcists not to confine them in that place. It is nevertheless considered as an indisputable fact, that there are an infinite number laid there, perhaps from its being a safer prison than any other nearer at hand; though neither history nor tradition gives us any instance of ghosts escaping or returning from this kind of transportation before their time.

"Another species of human apparition may be here noticed, though it does not come under the strict description of a ghost. These are the exact figures and resemblances of persons then living, often seen not only by their friends at a distance, but many times by themselves;

selves; of which there are several instances in Aubery's Miscellanies; one of Sir Richard Napier, a physician of London, who being on the road from Bedfordsire to visit a friend in Berkshire, saw at an inn his own apparation lying on his bed as a dead corpse; he nevertheless went forward, and died in a short time: another of Lady Diana Rich, daughter of the earl of Holland, who met her own apparition walking in a garden at Kensington, and died a month after of the smallpox. These apparitions are called *fetches;* in Cumberland, *swarths;* and in Scotland, *wraiths;* they most commonly appear to distant friends and relations, at the very instant preceding the death of the person whose figure they put on. Sometimes, as in the instances above mentioned, there is a greater interval between the appearance and death." For a philosophical inquiry into the subject of apparitions in general, see the article SPECTRE.

GIAGH, in *Chronology*, a cycle of 12 years; in use among the Turks and Cathayans.

Each year of a giagh bears the name of some animal: the first that of a mouse; the second that of a bullock; the third of a lynx or leopard; the fourth of a hare; the fifth of a crocodile; the sixth of a serpent; the seventh of a horse; the eighth of a sheep; the ninth of a monkey; the tenth of a hen; the eleventh of a dog; and the twelfth of a hog.

They also divide the day into 12 parts, which they call *giaghs*, and distinguish them by the name of some animals. Each giagh contains two of our hours, and is divided into eight kehs, as many as there are quarters in our hours.

GIALLOLINO, in *Natural History*, a fine yellow pigment, much used under the name of NAPLES YELLOW.

GIANT, a person of extraordinary bulk and stature.

The romances of all ages have furnished us with so many extravagant accounts of giants of incredible bulk and strength, that the existence of such people is now generally disbelieved. It is commonly thought, that the stature of men hath been the same in all ages; and some have even pretended to *demonstrate* the impossibility of the existence of giants mathematically. Of these our countryman M'Laurin hath been the most explicit. "In general (says he) it will easily appear, that the efforts tending to destroy the cohesion of beams arising from their own gravity only, increase in the quadruplicate ratio of their lengths: but that the opposite efforts tending to preserve their cohesion, increase only in the triplicate proportion of the same lengths. From which it follows, that the greater beams must be in greater danger of breaking than the lesser similar ones; and that though a lesser beam may be firm and secure, yet a greater similar one may be made so long, that it will necessarily break by its own weight. Hence Galileo justly concludes, that what appears very firm, and succeeds very well in models, may be very weak and infirm, or even fall to pieces by its own weight, when it comes to be executed in large dimensions according to the model. From the same principle he argues, that there are necessary limits in the operations of nature and art, which they cannot surpass in magnitude. Were trees of a very enormous size, their branches would fall by their own weight. Large animals have not strength in proportion to their size; and if there were any land animals much larger than those we know, they could hardly move, and would be perpetually subject to the most dangerous accidents. As to the animals of the sea, indeed the case is different; for the gravity of the water in a great manner sustains those animals; and in fact these are known sometimes to be vastly larger than the greatest land animals. Nor does it avail against this doctrine to tell us, that bones have sometimes been found which were supposed to have belonged to giants of immense size; such as the skeletons mentioned by Strabo and Pliny, the former of which was 60 cubits high, and the latter 46: for naturalists have concluded on just grounds, that in some cases these bones had belonged to elephants; and that the larger ones were bones of whales, which had been brought to the places where they were found by the revolutions of nature that have happened in past times. Though it must be owned, that there appears no reason why there may not have been men who have exceeded by some feet in height the tallest we have seen."

It will easily be seen, that arguments of this kind can never be conclusive; because, along with an increase of stature in any animal, we must always suppose a proportional increase in the cohesion of the parts of its body. Large works sometimes fail when constructed on the plan of models, because the cohesion of the materials whereof the model is made, and of the large work, are the same; but a difference in this respect will produce a very remarkable difference in the ultimate result. Thus, suppose a model is made of firwood, the model may be strong and firm enough; but a large work made also of fir, when executed according to the plan of the model, may be so weak that it will fall to pieces by its own weight. If, however, we make use of iron for the large work instead of fir, the whole will be sufficiently strong, even though made exactly according to the plan of the model. The like may be said with regard to large and small animals. If we could find an animal whose bones exceeded in hardness and strength the bones of other animals as much as iron exceeds fir, such an animal might be of a monstrous size, and yet be exceedingly strong. In like manner, if we suppose the flesh and bones of a giant to be greatly superior in hardness and strength to the bones of other men, the great size of his body will be no objection at all to his strength. The whole of the matter therefore concerning the existence of giants must rest on the credibility of the accounts we have from those who pretend to have seen them, and not on any arguments drawn *à priori*.

In the Scripture we are told of *giants*, who were produced from the marriages of the *sons of God* with the *daughters of men* †. This passage indeed has been differently interpreted, so as to render it doubtful whether the word translated *giants* does there imply any extraordinary stature. In other parts of Scripture, however, giants, with their dimensions, are mentioned in such a manner that we cannot possibly doubt; as in the case of Og king of Bashan, and Goliath. In a memoir read before the Academy of Sciences at Rouen, M. Le Cat gives the following acconnt of giants that are said to have existed in different ages.

† See *Antediluvians.*

"Profane historians have given seven feet of height to

Giant.

to Hercules their first hero; and in our days we have seen men eight feet high. The giant who was shown in Rouen in 1735, measured eight feet some inches. The emperor Maximian was of that size; Shenkius and Platerus, physicians of the last century, saw several of that stature; and Goropius saw a girl who was ten feet high.—The body of Orestes, according to the Greeks, was eleven feet and a half; the giant Galbara, brought from Arabia to Rome under Claudius Cæsar, was near ten feet; and the bones of Secondilla and Pusio, keepers of the gardens of Sallust, were but six inches shorter. Funnam, a Scotsman, who lived in the time of Eugene II. king of Scotland, measured eleven feet and a half; and Jacob le Maire, in his voyage to the Straits of Magellan, reports, that on the 17th of December 1615, they found at Port Desire several graves covered with stones; and having the curiosity to remove the stones, they discovered human skeletons of ten and eleven feet long. The chevalier Scory, in his voyage to the peak of Teneriffe, says, that they found in one of the sepulchral caverns of that mountain the head of a Guanche which had 80 teeth, and that the body was not less than 15 feet long. The giant Ferragus, slain by Orlando nephew of Charlemagne, was 18 feet high. Rioland, a celebrated anatomist, who wrote in 1614, says, that some years before there was to be seen in the suburbs of St Germain the tomb of the giant Isoret, who was 20 feet high. In Rouen, in 1509, in digging in the ditches near the Dominicans, they found a stone tomb containing a skeleton whose skull held a bushel of corn, and whose shin bone reached up to the girdle of the tallest man there, being about four feet long, and consequently the body must have been 17 or 18 feet high. Upon the tomb was a plate of copper, whereon was engraved, "In this tomb lies the noble and puissant lord the chevalier Ricon de Vallemont, and his bones." Platerus, a famous physician, declares, that he saw at Lucerne the true human bones of a subject which must have been at least 19 feet high. Valence in Dauphiné boasts of possessing the bones of the giant Bucart, tyrant of the Vivarais, who was slain with an arrow by the count de Cabillon his vassal. The Dominicans had a part of the shin bone, with the articulation of the knee, and his figure painted in fresco, with an inscription, showing that this giant was 22 feet and a half high, and that his bones were found in 1705, near the banks of the Morderi, a little river at the foot of the mountain of Crussol, upon which (tradition says) the giant dwelt.

"January 11, 1613, some masons digging near the ruins of a castle in Dauphiné, in a field, which (by tradition) had long been called the *giant's field*, at the depth of 18 feet discovered a brick tomb 30 feet long, 12 feet wide, and 8 feet high; on which was a gray stone, with the words *Theutobochus Rex* cut thereon. When the tomb was opened, they found a human skeleton entire, 25 feet and a half long, 10 feet wide across the shoulders, and five feet deep from the breast bone to the back. His teeth were about the size each of an ox's foot, and his shin bone measured four feet.—Near Mazarino, in Sicily, in 1516, was found a giant 30 feet high; his head was the size of an hogshead, and each of his teeth weighed five ounces. Near Palermo, in the valley of Mazara, in Sicily, a skeleton of a giant 30 feet long was found, in the year 1548; and another of 33 feet high, in 1550; and many curious persons have preserved several of these gigantic bones.

"The Athenians found near their city two famous skeletons, one of 34 and the other of 36 feet high.

"At Totu, in Bohemia, in 758, was found a skeleton, the head of which could scarce be encompassed by the arms of two men together, and whose legs, which they still keep in the castle of that city, were 26 feet long. The skull of the giant found in Macedonia, September 1691, held 210 pounds of corn.

"The celebrated Sir Hans Sloane, who treated this matter very learnedly, does not doubt these facts; but thinks the bones were those of elephants, whales, or other enormous animals.

"Elephants bones may be shown for those of giants; but they can never impose on connoisseurs. Whales, which, by their immense bulk, are more proper to be substituted for the largest giants, have neither arms nor legs; and the head of that animal hath not the least resemblance to that of a man. If it be true, therefore, that a great number of the gigantic bones which we have mentioned have been seen by anatomists, and by them have been reputed real human bones, the existence of giants is proved."

With regard to the credibility of all or any of these accounts, it is difficult to determine any thing. If, in any castle of Bohemia, the bones of a man's leg 26 feet in length are preserved, we have indeed a decisive proof of the existence of a giant in comparison of whom most others would be but pigmies. Nor indeed could these bones be supposed to belong to an elephant: for an elephant itself would but be a dwarf in comparison of such an enormous monster. But if these bones were really kept in any part of Bohemia, it seems strange that they have not been frequently visited, and particular descriptions of them given by the learned who have travelled into that country. It is certain, however, that there have been nations of men considerably exceeding the common stature. Thus, all the Roman historians inform us, that the Gauls and Germans exceeded the Italians in size; and it appears that the Italians in those days were of much the same stature with the people of the present age. Among these northern nations, it is also probable, that there would be as great differences in stature as there are among the present race of men. If that can be allowed, we may easily believe that some of the barbarians might be called *giants*, without any great impropriety. Of this superiority of size, indeed, the historian Florus gives a notable instance in Teutobochus, above mentioned, king of the Teutones: who being defeated and taken prisoner by Marius, was carried in triumph before him at Rome, when his head reached above the trophies that were carried in the same procession.

But whether these accounts are credited or not, we are very certain, that the stature of the human body is by no means absolutely fixed. We ourselves are a kind of giants in comparison of the Laplanders; nor are these the most diminutive people to be found upon the earth. The Abbé la Chappe, in his journey into Siberia in order to observe the last transit of Venus, passed through a village inhabited by people called *Wotiacks*,

Wotiacks, neither men nor women of whom were above four feet high. The accounts of the Patagonians also, which cannot be entirely discredited, render it very probable, that somewhere in South America there is a race of people very considerably exceeding the common size of mankind, and consequently that we cannot altogether discredit the relations of giants handed down to us by ancient authors; though what degree of credit we ought to give them is not easy to be determined. See PATAGONIA.

REBEL Giants, in ancient mythology, were the sons of Cœlus and Terra. According to Hesiod, they sprang from the blood of the wound which Cœlus received from his son Saturn, and Hyginus calls them sons of Tartarus and Terra. They are represented as men of uncommon stature, with strength proportioned to their gigantic size. Some of them, as Cottus, Briareus, and Gyges, had each 50 heads and 100 arms, and serpents instead of legs. They were of a terrible aspect, their hair hung loose about their shoulders, and their beard was suffered to grow unmolested. Pallene and its neighbourhood was the place of their residence. The defeat of the Titans, to whom they were nearly related, incensed them against Jupiter, and they all conspired to dethrone him. Accordingly they reared Mount Ossa upon Pelion, and Olympus upon Ossa; and from thence attacked the gods with huge rocks, some of which fell into the sea and became islands, and others fell on the earth and formed mountains. Jupiter summoned a council of the gods; when being informed that it was necessary to obtain the assistance of some mortal, he by the advice of Pallas called up his son Hercules; and with the aid of this hero he exterminated the giants Enceladus, Polybotes, Alcyon, Porphyrion, the two sons of Alœus, Ephialtes, Othus, Eurytus, Clytius, Tithyus, Pallas, Hippolitus, Agrius, Thoon, and Typhon; the last of whom it was more difficult to vanquish than all the others. Jupiter having thus gained a complete victory, cast the rebels down to Tartarus, where they were to receive the full punishment of their enormous crimes: according to the accounts of some of the poets, he buried them alive under Mount Ætna and different islands.

GIANTS Causeway, a vast collection of basaltic pillars in the county of Antrim, on the north coast of Ireland. See BASALTES.

The principal or grand causeway consists of a most regular arrangement of many hundred thousands of columns of a black kind of rock, very hard: almost all of them are of a pentagonal figure, but so closely and compactly situated on their sides, though perfectly distinct from top to bottom, that scarce any thing can be introduced between them. The columns are of an unequal height and breadth; some of the highest, visible above the surface of the strand, and at the foot of the impending angular precipice, may be about 20 feet; they do not exceed this height, at least none of the principal arrangement. How deep they are fixed in the strand, was never yet discovered. This grand arrangement extends nearly 200 yards, visible at low water; how far beyond is uncertain: from its declining appearance, however, at low water, it is probable it does not extend under water to a distance any thing equal to what is seen above. The breadth of the principal causeway, which runs out in one continued range of columns, is, in general, from 20 to 30 feet; at one place or two it may be nearly 40 for a few yards. In this account are excluded the broken and scattered pieces of the same kind of construction, that are detached from the sides of the grand causeway, as they do not appear to have ever been contiguous to the principal arrangement, though they have frequently been taken into the width: which has been the cause of such wild and dissimilar representations of this causeway, which different accounts have exhibited. The highest part of this causeway is the narrowest, at the very foot of the impending cliff from whence the whole projects, where, for four or five yards, it is not above ten or fifteen feet wide. The columns of this narrow part incline from a perpendicular a little to the westward, and form a slope on their tops, by the very unequal height of the columns on the two sides, by which an ascent is made at the foot of the cliff, from the head of one column to the next above, *gradatim*, to the top of the great causeway, which, at the distance of half a dozen yards from the cliff, obtains a perpendicular position, and lowering in its general height, widens to about 20 or between 20 and 30 feet, and for 100 yards nearly is always above water. The tops of the columns for this length being nearly of an equal height, they form a grand and singular parade, that may be easily walked on, rather inclining to the water's edge. But from high water mark, as it is perpetually washed by the beating surges on every return of the tide, the platform lowers considerably, and becomes more and more uneven, so as not to be walked on but with the greatest care. At the distance of 150 yards from the cliff, it turns a little to the east for 20 or 30 yards, and then sinks into the sea. The figure of these columns is almost unexceptionably pentagonal, or composed of five sides; there are but very few of any other figure introduced: some few there are of three, four, and six sides, but the generality of them are five-sided, and the spectator must look very nicely to find any of a different construction: yet what is very extraordinary, and particularly curious, there are not two columns in ten thousand to be found, that either have their sides equal among themselves, or whose figures are alike. Nor is the composition of these columns or pillars less deserving the attention of the curious spectator. They are not of one solid stone in an upright position; but composed of several short lengths, curiously joined, not with flat surfaces, but articulated into each other like ball and socket, or like the joints in the vertebræ of some of the larger kind of fish, the one end at the joint having a cavity, into which the convex end of the opposite is exactly fitted. This is not visible, but by disjoining the two stones. The depth of the concavity or convexity is generally about three or four inches. And what is still farther remarkable of the joint, the convexity, and the correspondent concavity, is not conformed to the external angular figure of the column, but exactly round, and as large as the size or diameter of the column will admit; and consequently as the angles of these columns are in general extremely unequal, the circular edges of the joint are seldom coincident with more than two or three sides of the pentagon, and from the edge of the circular part of the joint to the exterior sides and angles they are quite plain. It is still

still farther very remarkable, likewise, that the articulations of those joints are frequently inverted; in some the concavity is upwards, in others the reverse. This occasions that variety and mixture of concavities and convexities on the tops of the columns, which is observable throughout the platform of this causeway, yet without any discoverable design or regularity with respect to the number of either. The length also of these particular stones, from joint to joint, is various: in general, they are from 18 to 24 inches long; and, for the most part, longer toward the bottom of the columns than nearer the top, and the articulation of the joints something deeper. The size or diameter likewise of the columns is as different as their length and figure; in general, they are from 15 to 20 inches in diameter. There are really no traces of uniformity or design discovered throughout the whole combination, except in the form of the joint, which is invariably by an articulation of the convex into the concave of the piece next above or below it; nor are there any traces of a finishing in any part, either in height, length, or breadth, of this curious causeway. If there is here and there a smooth top to any of the columns above water, there are others just by, of equal height, that are more or less convex or concave, which show them to have been joined to pieces that have been washed, or by other means taken off. And undoubtedly those parts that are always above water have, from time to time, been made as even as might be; and the remaining surfaces of the joints must naturally have been worn smoother by the constant friction of weather and walking, than where the sea, at every tide, is beating upon it and continually removing some of the upper stones and exposing fresh joints. And farther, as these columns preserve their diameters from top to bottom, in all the exterior ones, which have two or three sides exposed to view, the same may with reason be inferred of the interior columns whose tops only are visible. Yet what is very extraordinary, and equally curious, in this phenomenon, is, that notwithstanding the universal dissimilitude of the columns, both as to their figure and diameter, and though perfectly distinct from top to bottom, yet is the whole arrangement so closely combined at all points, that hardly a knife can be introduced between them either on the sides or angles.

The cliffs at a great distance from the causeway, especially in the bay to the eastward, exhibit at many places the same kind of columns, figured and jointed in all respects like those of the grand causeway: some of them are seen near to the top of the cliff, which in general, in these bays to the east and west of the causeway, is near 300 feet in height; others again are seen about midway, and at different elevations from the strand. A very considerable exposure of them is seen in the very bottom of the bay to the eastward, near a hundred roods from the causeway, where the earth has evidently fallen away from them upon the strand, and exhibits a most curious arrangement of many of these pentagonal columns, in a perpendicular position, supporting, in appearance, a cliff of different strata of earth, clay, rock, &c. to the height of 130 feet or more, above. Some of these columns are between 30 and 40 feet high, from the top of the sloping bank below them; and, being longest in the middle of the arrangement, shortening on either hand in view, they have obtained the appellation of *organs*, from a rude likeness in this particular to the exterior or frontal tubes of that instrument; and as there are few broken pieces on the strand near it, it is probable that the outside range of columns that now appears is really the original exterior line, to the seaward, of this collection. But how far they extend internally into the bowels of the incumbent cliff, is unknown. The very substance, indeed, of that part of the cliff which projects to a point, between the two bays on the east and west of the causeway, seems composed of this kind of materials; for besides the many pieces that are seen on the sides of the cliff that circulate to the bottom of the bays, particularly the eastern side, there is, at the very point of the cliff, and just above the narrow and highest part of the causeway, a long collection of them seen, whose heads or tops just appearing without the sloping bank, plainly show them to be in an oblique position, and about half way between the perpendicular and horizontal. The heads of these, likewise, are of mixed surfaces, convex and concave, and the columns evidently appear to have been removed from their original upright, to their present inclining or oblique position, by the sinking or falling of the cliff.

GIBBET, or GIBET, a machine in manner of a gallow, whereon notorious criminals, after execution, are hung in irons or chains, as spectacles *in terrorem*. See GALLOWS.—The word in French, *gibet*, properly denotes what we call gallows: it is supposed to come originally from the Arabic *gibel*, "mount or elevation of ground;" by reason *gibets* are usually placed on hills or eminences.

GIBBON, EDWARD, a historian of distinguished eminence, was born at Putney in the year 1737. He was the son of a gentleman of fortune and family distinction, who sat as a member in two separate parliaments. Edward when a boy, was of such an extremely delicate constitution that his life was frequently despaired of. When at the school of Westminster, his progress was often retarded by repeated shocks of bad health. After being for a long time under the management of the best medical practitioners, his constitution was radically changed for the better, which induced his father to place him in Magdalen college as a gentleman commoner, that he might be pushed into manly acquisitions. This was prior to the completing of his fifteenth year. Before this time his reading had been of such a nature as to store his mind with much valuable historical knowledge, although his grammatical and philosophical knowledge at this time was not so extensive as that of some others at the same period of life. He says of himself; I arrived at Oxford with a stock of erudition that might have puzzled a doctor, and a degree of ignorance of which a school-boy would have been ashamed. Under such circumstances he was but ill prepared to receive the benefits of an university education, and this was no doubt the reason why he exclaimed so bitterly against the public and private instructions at Oxford.

He was fond of polemical divinity from his infancy, and during his leisure moments he turned his attention, when farther advanced, to the celebrated controversy between Papists and Protestants; and as he had not then acquired talents sufficient to enable him to combat error

Gibbon.

error and defend the truth, he fell a victim to the sophistry of the church of Rome. His father, with a view to reclaim him from the love of what he considered as the most destructive of all errors, sent him to Lausanne in Switzerland, and put him under the care of Mr Pavilliard, a clergyman of the Calvinistic persuasion. This gentleman called his pupil Edward, "A little thin figure, with a large head, disputing, and urging with the greatest ability, all the best arguments that had ever been used in favour of Popery." The masterly exertions of Mr Pavilliard, who had to deal with a young man of solid reason and matured reflection, accomplished the recantation of Mr Gibbon, and he received the sacrament in the Protestant church on the 25th of December 1754. At Lausanne, too, he made great progress in many branches of knowledge which he had hitherto neglected, and acquired a regular habit of study. He became master of the French and Latin languages, and was a profound logician. He gave full scope to the exercise of reading excellent authors, which was his ruling passion. He did not appear fond of mathematics, and therefore soon relinquished the study of them. At Lausanne he fell in love with a young lady, the daughter of a village clergyman; but he was frustrated in his hopes, and the lady became afterwards the wife of the celebrated Necker.

On his return home in April 1758, his father received him with every mark of tenderness and affection, and his mother-in-law found means to conciliate his good opinion and his confidence. It is a singular circumstance that he should have taken a captain's commission in the army, a profession, one would have imagined, for which he was very ill calculated. Indeed he soon evinced the truth of this, for his tent and quarters were frequently encumbered with the odd furniture of Greek and Latin authors. On the event of peace he resigned his commission, and paid a visit to Paris in the year 1763, where he resided a few months, and afterwards went to Lausanne, where he remained about a year, in order to prepare for a journey into Italy, which he accomplished in 1765. He thus speaks on the occasion of his entering Rome: "After a sleepless night, I trod, with a lofty step, the ruins of the forum; each memorable spot, where Romulus stood, or Tully spoke, or Cæsar fell, was at once present to my eye; and several days of intoxication were lost or enjoyed before I could descend to a cool and minute investigation." On the 15th of October, he informs us, the idea of writing the decline and fall of Rome first came into his mind, when the bare-footed friars were singing vespers in the temple of Jupiter.

In the year 1770 Mr Gibbon lost his father, and succeeded to an estate which was very much involved; yet he considered his circumstances as very well adapted to the great and extensive work he had undertaken to accomplish, which in his own opinion he had probably never finished, if he had been either poorer or richer than he was. He had an extensive circle of acquaintance in London, but the time necessarily devoted to their company, he made up by early rising and intense application. In the year 1774 he was chosen member of parliament for the borough of Liskeard, by the influence of Lord Elliot, which threatened to give his studies a very serious interruption. He sat eight years in the house of commons without having the courage so much as once to open his mouth, notwithstanding he was such an elegant writer. When the first volume of his "Decline and Fall of the Roman Empire," made its appearance in 1776, it met with a greater degree of applause than he expected; but by no praise was he so highly gratified as by that which the two great historians of Scotland, Hume and Robertson, bestowed upon him. For his two chapters which relate to the spread of Christianity he met with many antagonists, to whom he made no reply but to a Mr Davis, which was considered as a masterpiece. There can be no doubt that Gibbon was a real enemy to revelation in the disguise of a believer, a conduct not so abominable as at first sight may appear, so long as penal laws exist against an open declaration of opinion.

Gibbon, Gibbous.

Soon after the publication of the first volume of his history, he paid another visit to Paris, and did not appear to be in much haste to complete his extensive work. In 1781, however, the second and third volumes of his history were given to the world; and although in the estimation of many competent judges they were inferior to the first, they still were allowed to possess sufficient merit to support his reputation. Having lost his seat for Liskeard, the influence of ministry brought him in as representative for Lymington, and on the dissolution of Lord North's ministry, he lost his office as one of the lords of trade, which was a serious diminution of his income. He again determined to visit his favourite Lausanne, where he completed the remaining volumes of his history; but when the revolutionary mania began to rage on the continent, he quitted Lausanne, and sought for an asylum in England. He mortally hated innovations of every kind, whether necessary or not, as appears from the following exclamation: "I beg leave to subscribe my assent to Mr Burke's creed on the revolution of France. I admire his eloquence, I approve his politics, I adore his chivalry, and can almost excuse his reverence for church establishments,"

During his consoling visit to Lord Sheffield, who had met with a trying domestic loss, his attention was called to the rapid progress of a distemper which had subsisted for about 30 years. A mortification at last ensued, which terminated his existence on the 16th of January 1794, in the 67th year of his age. Mr Gibbon gives himself a character which is perhaps pretty near the truth. "I am endowed with a cheerful temper, a moderate sensibility, and a natural disposition to repose rather than to activity: some mischievous appetites and habits have perhaps been corrected by philosophy or time. The love of study supplies each day, each hour, with a perpetual source of independent and rational pleasure." Mr Gibbon possessed the manners and sentiments of a gentleman in an eminent degree; he was easy in society, of which he was extremely fond, and beloved by all who had the pleasure of intimately knowing him.

GIBBOUS, a term in *Medicine*, denoting any protuberance or convexity of the body, as a person hunched or hump-backed.

Infants are much more subject to gibbosity than adults, and it oftener proceeds from external than internal causes. A fall, blow, or the like, frequently thus distorts the tender bones of infants. When it proceeds

from

from an internal cause, it is generally from a relaxation of the ligaments that sustain the spine, or a caries of its vertebræ; though the spine may be inflected forward, and the vertebræ thrown out by a too strong and repeated action of the abdominal muscles. This, if not timely redressed, grows up and fixes as the bones harden, till in adults it is totally irretrievable: but when the disorder is recent, and the person young, there are hopes of a cure. The common method is by a machine of pasteboard, wood, or steel, which is made to press principally on the gibbous part; and this by long wearing may set all right. The surgeons, however, have a different instrument, which they call a *cross*, much more efficacious, though not quite so convenient in the wearing. By the use of this, the parts are always prevented from growing any worse, and are often cured. During the application of these assistances, the parts should be at times rubbed with Hungary water, spirit of lavender, or the like, and defended with a strengthening plaster.

GIBBOUS, in *Astronomy*, a term used in reference to the enlightened parts of the moon, whilst she is moving from the first quarter to the full, and from the full to the last quarter; for all that time the dark part appears horned or falcated; and the light one hunched out, convex, or gibbous.

GIBEAH, a city in the tribe of Benjamin, lying north of Jerusalem about 20 or 30 furlongs, and built upon a hill, as its name imports.—This city gave birth to Saul, the first king of Israel, for which reason it is frequently called Gibeah of Saul, or Gibeah the native country of Saul.

GIBELINS, or GIBELLINS, a famous faction in Italy, opposite to another called the GUELPHS.

Those two factions ravaged and laid waste Italy for a long series of years; so that the history of that country, for the space of two centuries, is no more than a detail of their mutual violences and slaughters. The Gibelins stood for the emperor against the pope: but concerning their origin and the reason of their names we have but a very obscure account. According to the generality of authors, they rose about the year 1240, upon the emperor Frederick II.'s being excommunicated by Pope Gregory IX. Other writers maintain, that the two factions arose ten years before, though still under the same pope and emperor. But the most probable opinion is that of Maimbourg, who says, that the two factions of Guelphs and Gibelins arose from a quarrel between two ancient and illustrious houses on the confines of Germany, that of the Henries of Gibeling, and that of the Guelphs of Adorf.

GIBEON, a city seated on an eminence about 40 furlongs from Jerusalem northward, and not far from the city of Gibeah. See GEBA.

This was the capital city of the Gibeonites, who took the advantage of Joshua's oath, and of that which the elders of Israel likewise swore to them, upon an artificial representation which they made of their belonging to a very remote country, and their desire of making an alliance with the Hebrews. Joshua (ix. 3. 4, *et seq.*) and the elders inconsiderately entered into a league with these people; but soon discovered their mistake. Upon this, sending for the Gibeonites, they reproached them with their fraud; and without revoking the promise which they had made to them, of giving them their lives, they condemned them to carry wood and water to the tabernacle of the Lord, as slaves and captives taken in war; in which state of servitude they remained till the ruin and entire dispersion of the Jewish nation.

The Gibeonites were descended from the Hivites, the old inhabitants of that country, and possessed four cities, whereof Gibeon was the capital. The cities were Chephirath, Beeroth, Kirjathjearim, and Gibeon, Josh. ix. 17. These cities were afterwards given to the tribe of Benjamin, except Kirjathjearim, which fell to the tribe of Judah. The Gibeonites continued ever after subject to those burdens which Joshua had imposed on them, and were very faithful to the Israelites.

GIBLETS, the offals or entrails of a goose; including the heart and liver, with the feet, gizzard, &c. The word is supposed to be formed of *goblets*, from the French *gobeau*, "mouthful."—Giblets make a considerable article in cookery: they boil giblets, stew giblets, make ragouts of giblets, giblet pies, &c.

GIBRALTAR, a famous promontory, or rather peninsula, of Spain, lying in N. Lat. 36. 6. W. Long. 5. 17. To the ancients it was known by the name of *Calpe*, and was also called one of the *Pillars of Hercules*; by the Arabians it is called *Gebel Tarek*, that is, "the mount of Tarek," from *Tarek*, the name of the Saracen general who conquered Spain in the beginning of the eighth century. The whole is an immense rock, rising perpendicularly about 440 yards, measuring from north to south about two English miles, but not above one in breadth from east to west. The town lies along the bay on the west side of the mountain on a declivity; by which, generally speaking, the rains pass through it, and keep it clean. The old town was considerably larger than the new. Many of the streets are narrow and irregular: the buildings are of different materials; some of natural stone out of the quarries, some of a factitious or artificial stone, and a few of brick. The people are supplied with fresh provisions chiefly from the coast of Barbary, with fruit, roots, and vegetables of all sorts from thence, or from their own gardens. Besides what is properly called the town, there are several spacious and commodious public edifices erected; such as barracks for the soldiers, with apartments for their officers, magazines of different kinds, storehouses for provisions, &c. The inhabitants, exclusive of the British subjects dependent on the garrison, or who reside there from other motives, consist of some Spaniards, a few Portuguese, a considerable number of Genoese, about as many Jews, and even some Moors; making in the whole a population of twelve thousand persons, without reckoning the garrison; though some make them much fewer. This town may be said to have two ports; the first lying to the north, and is proper only for small vessels; the other is very commodious for large vessels, and has a fine stone quay. The bay is very beautiful and capacious, being in breadth about five miles, and in length eight or nine, with several small rivers running into it. It is very advantageous to the place. There is no ground to be found in the middle of it at one hundred fathoms depth, so that a squadron may lie there in great safety; the breezes from it are very refreshing; and it contributes likewise

Gibraltar. likewise to the subsistence of the inhabitants by supplying them with plenty of fish.

The strait of Gibraltar, through which the ocean passes into the Mediterranean, thereby dividing Europe from Africa, runs from west to east about 13 leagues. In this strait there are three remarkable promontories or capes on the Spanish side, and as many opposite to them on the Barbary side. The first of these, on the side of Spain, is Cape Trafalgar, opposite to which is Cape Spartal; and in the neighbourhood of this stood the fortress of Tangier, once in the possession of the British. The next on the Spanish side is Tariffa; and opposite it lies Malabata, near the town of Alcassar, where the straits are about five leagues broad. Lastly, Gibraltar facing the mountain of Abyla, near the fortress and town of Ceuta, which make the eastern entry of the straits.

1 rtress erected the Saens.

This important fortress seems to have been first particularly noticed as a place of consequence in the year 712 At that time the general of the caliph Al Walid landed with an army of 12,000 men on the isthmus between Mount Calpe and the continent; and that he might secure an intercourse with Africa, ordered a castle to be built on the face of that hill. Part of the building still remains; and, from an inscription discovered above the principal gate, appears to have been finished in 725. It continued in the possession of the Saracens till the beginning of the 14th century, when it was recovered by Ferdinand king of Castile. In 1333, however, it was obliged to surrender to the son of the emperor of Fez, who came to the assistance of the Moorish king of Granada. An attempt was made upon it in 1349 by Alonso king of Castile; but when the fortress had been reduced to the last extremity, a pestilential fever broke out in the Spanish camp, which carried off the king himself, with great part of his army; after which the enterprise was abandoned.

2 rious revtions.

The fortress continued in the possession of the Saracen descendants of the prince of Fez until the year 1410, when it was taken possession of by Joseph III. king of Granada. A design of attacking it was formed by Henry de Gusman in 1435; but the enterprise having miscarried through his imprudence, he was defeated and slain. However, it was at length taken after a gallant defence by his son John de Gusman in 1462; since which time it has remained in the hands of the Christians. In 1540, it was surprised and pillaged by Piali Hamet, one of Barbarossa's corsairs; but the pirates having fallen in with some Sicilian galleys, were by them defeated, and all either killed or taken.

3 Itrtificatiim pred and stgthened.

In the reign of Charles V. the fortifications of Gibraltar were modernized, and such additions made as to render them almost impregnable. It was taken by the English, however, in the reign of Queen Anne, and since that time has remained in their possession; and probably will always do so, unless ceded by treaty, as it appears altogether impossible to reduce it by any force of artillery, let it be ever so great. In the year 1704, in consequence of the resolution adopted by the court of Britain to assist the archduke Charles in his pretensions to the Spanish crown, Sir George Rooke was sent with a powerful fleet into the Mediterranean. His orders being limited, nothing of consequence was done for some time, until at last an attempt on Gibraltar was resolved upon; not so much on account of the importance of the conquest, as to prevent any reflections against the admiral for inactivity. On the 21st of July that year, 1800 troops were landed upon the isthmus, under the command of the prince of Hesse Darmstadt; and on the refusal of the governor to surrender, preparations were made for attacking the place. Early in the morning of the 23d, a cannonade was begun from the fleet, and kept up so briskly, that in five or six hours the Spaniards were driven from many of their guns, especially at the new mole head. The admiral perceiving, that, by gaining this part of the fortification, the reduction of the rest would be facilitated, ordered out some armed boats to take possession of it. On their approach the Spaniards sprung a mine, which demolished part of the works, killed two lieutenants and 40 private soldiers, wounding about 60 more. Notwithstanding this disaster, the assailants kept possession of the work, and took a small bastion, now the eight-gun battery, half way between the mole and the town. On this the governor thought proper to capitulate, and the prince of Hesse took possession of the gates on the 24th. The garrison, consisting at most of 150 men, marched out with the honours of war; and the Spaniards who chose to remain were allowed the same privileges they had enjoyed under the reign of Charles II. The works were found very strong, and the place well provided with ammunition and military stores.

4 Tn by Sieorge Re in 17

This conquest was achieved with the loss of about 60 killed and 216 wounded on the part of the English. The prince of Hesse remained governor; and 18 men of war were left at Lisbon under the command of Sir John Leake, to succour the garrison if there should be occasion. The loss of such an important fortress, however, having alarmed both the courts of Madrid and Paris, orders were sent to the Marquis de Villadarias, a Spanish grandee, to lay siege to it, in which he was to be assisted by a naval force from Toulon. The prince immediately applied to Sir John Leake for assistance; but before the latter had time to comply with his request, a French fleet arrived, and debarked six battalions to the assistance of the Spaniards; after which they proceeded to the westward, leaving only six frigates in the bay. The trenches were opened on the 11th of October, about which time Sir John arrived with 20 sail of English and Dutch ships; but hearing that the French were about to attack him with a superior force, he judged it proper to return and refit. Having very prudently left orders at Lisbon to make preparations for this purpose in his absence, he was enabled to accomplish this work with such expedition, that on the 29th of the same month, he returned and surprised in the bay three frigates, a fire ship, two English prizes, a tartan, and a store ship. After this exploit he landed some reinforcements, supplied the garrison with six months provision and ammunition; at the same time detaching on shore a body of 500 sailors to assist in repairing the breaches which had been made by the enemy's fire.

5 Besieged the same year by the Marquis de Villadarias.

6 The garrison supplied with reinforcements and provisions by Sir John Leake.

Thus the Spaniards were disappointed in their hopes of success from an attack which had been projected that very night, and for which purpose 200 boats had been collected. Still, however, they did not despair; and

Gibraltar. and supposing that the garrison would be off their guard and secure on account of the vicinity of their fleet, they formed the rash design of attempting to surprise the place, though the British admiral was still before it. In this mad attempt 500 volunteers associated, taking the sacrament never to return unless they accomplished their purpose. They were conducted by a goat-herd to the south side of the rock near the cave guard, at that time called *the pass of locust trees*. This they mounted, and lodged themselves the first night in the cave of St Michael: the next they scaled Charles V.'s Wall; surprised and massacred the guard at Middle hill; where afterwards, by ropes and ladders, several hundreds of the party designed to support them were hauled up: but being discovered, they were attacked by a strong party of grenadiers, and all of them at last either killed or taken. These brave adventurers were to have been supported by a body of French troops, and some feints were proposed to draw off the attention of the garrison; but, through the disagreement of the commanding officers, these proposals were not put in execution, and thus the volunteers were left to their fate.

7 Desperate attempt of some Spanish volunteers.

8 They are all killed or taken.

9 The siege still continued.

Notwithstanding these misfortunes, the Spaniards still continued the siege, and fitted out a strong squadron from Cadiz, with a design to intercept the convoys of provisions which might be sent to the garrison; flattering themselves at the same time, that, on the arrival of their fleet, Sir John would be obliged to retire, and the garrison of consequence to surrender to their united attacks. They continued their fire therefore with additional fury, dismounted many of the cannon, and did essential injury to the works in several different places. The prince of Hesse, however, was by no means deficient in his endeavours to disappoint their expectations. As it was probable that an attempt might be made to storm the curtain, a cuvette was dug in the ditch, which was filled by the tide, and a double row of palisades placed parallel to the works. The chambers of the mine under the glacis were loaded, and all means taken to defeat such an attempt; but on a sudden the Spaniards seemed to have altered their design, and threatened an attack on the lines which the garrison had on the declivity of the hill to flank the glacis, and overlook their advanced works. While affairs remained in this situation, part of the succours they had long expected arrived in the bay, December 7. 1704, and in two days after, the remainder came in with near 2000 men, along with a proportionable quantity of ammunition and provisions. These had sailed from Cape Spartel under convoy of four frigates; but were in imminent danger of falling into the hands of the enemy, whose fleet they mistook for their own; however, they escaped by the fortunate circumstance of being becalmed, so that they could not get up to them.

10 The garrison reinforced.

Sir John Leake having thus powerfully reinforced the garrison, thought his presence in the bay no longer necessary, and therefore set sail for Lisbon, where he arrived about the end of the year. In the beginning of January 1705 the Spaniards were reinforced by a considerable body of infantry, and on the 11th of the month made an attack on the extremity of the King's Lines, but were repulsed. The attack was renewed next day with 600 grenadiers, French and Walloons, supported by 1000 Spaniards, under Lieutenant General Fuy. They disposed themselves in such a manner as showed an intention to storm a breach which had been made in the Round Tower at the extremity of the King's Lines, and another in the intrenchment on the hill. The retrenchment which covered the latter breach, with part of the intrenchment joining the precipice of the rock, was defended at night by a captain, three subalterns, and 90 men; but it was customary for the captain to withdraw, with two subalterns and 60 men at daybreak. The Round Tower was defended by 180 men, commanded by a lieutenant-colonel. The marquis, by deserters from the garrison, had obtained intelligence of the strength of these posts, and planned his attack accordingly. The detachment for the upper breach mounted the rock at midnight, and concealed themselves in the clifts until the captain had withdrawn; after which, advancing to the point of the intrenchment, they threw grenades on the subaltern and his party, so that they were obliged to leave the place. At the same time 300 men stormed the Round Tower, where Lieutenant Colonel Bar made a vigorous defence, though the enemy, having passed the breach above, annoyed them on the flanks with great stones and grenades. Observing, however, the Spaniards marching down to cut off his retreat from the town, he retired; and, by getting over the parapet of the King's Lines, descended into the covered way, where the English guards were posted. Thus the garrison were alarmed; all the regiments were assembled at their proper posts; and Captain Fisher endeavoured to stop the progress of the enemy with 17 men, but they were repulsed, and himself taken prisoner. At last, however, the Tower was retaken by Lieutenant Colonel Moncal at the head of 400 or 500 men, after it had been in the possession of the enemy upwards of an hour.

11 Vigorous attack by the Spaniards.

12 They are repulsed.

The garrison was now farther reinforced by six companies of Dutch troops and 200 English soldiers, together with some provisions and stores. The assailants, however, were still determined to go on. The marquis de Villadarias was superseded by Mareschal Tesse, a Frenchman, with whom Admiral Pointis was desired to co-operate in blocking up the place. The mareschal therefore joined the army with four fresh battalions, besides eight companies which had been sent before; the ordnance, which had been greatly injured by constant use, was exchanged for others, and the works as they then stood, put into the best repair. On the part of the English, a reinforcement was ordered under the command of Sir Thomas Dilkes and Sir John Hardy, to join Admiral Leake at Lisbon: which junction being effected, the whole fleet, consisting of 28 English, 4 Dutch, and 8 Portuguese men of war, having on board two battalions of land forces, set sail from Lisbon. Happily for the besieged, however, the incessant rains and storms about this time had retarded the operations of the land forces, and greatly distressed the fleet of the enemy. Eight ships of the latter were forced from their anchors by the strong westerly wind, and obliged to drive aloft. At this critical period Sir John Leake, with the allied fleet, entered the straits. On his approach the few remaining French ships put out to sea; and the British admiral discovering five sail making out of the bay, and a gun fired at them from the garrison,

13 The siege carried on with fresh ardour.

14 The French fleet dispersed by a storm.

garrison, immediately gave chase. Three French men of war were taken, and the admiral's ship and another driven on shore, where they were burnt. The rest, on hearing the report of the guns, had made the best of their way to Toulon.

15 The siege turned into a blockade, and at last raised.

The garrison was now so well supplied, that Mariſchal Teſſe withdrew his troops from the trenches, and formed a blockade, drawing an intrenchment across the iſthmus to prevent the garrison from ravaging the country. The prince of Heſſe remained for some time in the place, where he repaired the batteries, and made some additions to the fortifications; after which he joined the archduke Charles at Lisbon. As the latter, however, was resolved to try his fortune with the earl of Peterborough in Valencia and Catalonia, the prince was sent back to Gibraltar to prepare part of the garrison for embarkation, and soon after was followed by the whole fleet. Major General Ramos was now appointed governor of Gibraltar, in which only two new battalions were left, as nothing was to be feared from the enemy. The new governor, however, brought with him 400 men for the greater security of the place; but soon resigned his government to Colonel Roger Elliot, during whose time Gibraltar was made a free port by a special order from the queen.

Colonel Elliot was succeeded by Colonel Congreve before the year 1714, and he by Colonel Cotton a short time after. In 1720 the Spaniards seem to have threatened another attack. Ceuta, a Spanish fortress in Barbary, had been for many years besieged by the Moors; and a powerful armament, commanded by the marquis de Lada, was now assembled in Gibraltar bay, under pretence of relieving the African fortress, but with a secret design of first surprising Gibraltar; for which purpose they had provided scaling ladders, &c. The armament, however, had not been fitted out with such secrecy, but that the British ministry had intelligence of it. On this they sent orders to Colonel Kane, governor of Minorca, to embark with part of his garrison for Gibraltar under convoy of the fleet in the Mediterranean. On his arrival he found the place in a critical situation. The garrison consisted only of three weak battalions under Major Hetherington, besides whom there was only one other field officer, Major Batteroux, in the place, and no more than 14 days provisions remaining. The posture of affairs, however, was altered by the arrival of Colonel Kane with 500 men, with provisions and ammunition; which reinforcement, together with the spirited behaviour of the British commodore, induced the Spanish commander to abandon his design, though he remained of opinion that the fortress might then have been carried by a general assault.

16 A new attempt threatened by the Spaniards in 1720.

17 The design given up.

18 Another attempt in 1726.

Notwithstanding this disappointment, the Spaniards continued to keep a watchful eye over Gibraltar; and, in the latter end of the year 1726, assembled an army in the neighbourhood of Algesiras, encamping, on the 20th of January following, on the plain below St Roch, and erecting a battery on the beach to protect their camp. Though Admiral Hopson was then at anchor in the bay of Gibraltar, yet, as he had received no intelligence of the actual commencement of hostilities between Britain and Spain, he was obliged to allow the boats of the latter to pass with provisions, arms, and ammunition, between Algesiras and the camp, at the same time that Colonel (afterwards Brigadier) Kane, who had been a second time sent from Minorca, lay under similar embarrassments. The operations of the Spaniards, however, seemed so evidently to tend towards an attack, that the governor thought proper to order such of that nation as were in the town to leave it, and to forbid their galleys to anchor under his guns (A).

The count de las Torres commanded the Spanish forces, amounting to near 20,000 men; and soon after forming his camp, he advanced within reach of the garrison. The brigadier then desired him to keep out of his reach, otherwise he should do his utmost to force him; but to this the Spanish commander replied, that, as the garrison could command no more than they had power to maintain, he should obey his Catholic majesty's orders, and encroach as far as possible. Hostilities, however, were not commenced until the 10th of February 1727, when the Spaniards, having brought materials for batteries to the old windmill on the neutral ground, it was determined in a council of war, that the Spanish general had commenced hostilities by encroaching so far on the liberties of the garrison. Still, however, the governor sent to the count to know the reason of breaking ground before the garrison; but received for answer, that "he was in his master's territories, and was not answerable to any other person for his conduct." On this the governor opened the batteries of the Old Mole and those of Willis upon the Spanish workmen: however, they persisted on carrying on their operations, and at night marched a party down to the Devil's Tower, where they immediately broke ground, and began a communication with their other works. The governor was now informed by some deserters, that the enemy were forming a mine in a cave under Willis's Battery, with a design to blow it up: but the plot being thus happily discovered, a party was immediately stationed to cut off the communication. On the 22d of February the Spaniards opened on the garrison with 17 pieces of cannon besides mortars; and the day following Brigadier Kane left Gibraltar to send a reinforcement from Minorca. On the 3d of March the enemy opened a new battery of 22 guns, on the Old Mole, and on the 8th another of 15 guns, bearing also upon the same mole, the guns of which had annoyed the western flank of their approaches.

All this time the garrison had kept up a constant and well directed fire from the batteries which bore upon the works of the enemy; but the ordnance in general being old, were frequently bursting; by which they suffered more than from the fire of the besiegers. The

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(A) At this time the fortifications of Gibraltar were considerably different from what they had been in 1705. Several works were erected on the heights above the lines called *Willis's Batteries*; the Prince's Lines were extended to the extremity of the rock, and an inundation was formed out of the morass in front of the grand battery.

Gibraltar.

The latter were also greatly distressed by the fleet under Admiral Hopson and Sir Charles Wager, who, since the beginning of the siege, had intercepted their homebound ships, and at the same time greatly benefited the garrison, by bringing the prizes into the bay. Finding the Spaniards, however, obstinately bent on their enterprise, they formed a design, on the 2d of April, to bombard Algesiras, from whence the besiegers were supplied with various articles of ammunition; but the fleet happening to be becalmed, the design was afterwards unaccountably abandoned; and on the arrival of a reinforcement from Minorca, they sailed to the westward, leaving the garrison to defend themselves the best way they could.

The enemy continued to augment their batteries, and erect new ones, until they amounted at last to 60 cannon besides mortars; and, on the 3d of May, the governor received intelligence that a general assault was intended; to repel which he took every proper precaution. The enemy, however, still added to their approaches, and considerable reinforcements were received by both parties.

19 Cessation of hostilities.

Hostilities, however, ceased on the 12th, when news arrived that the preliminaries of a general peace were signed; from which time to the year 1779, no farther attempts were made on Gibraltar.

20 Great loss of the Spaniards in their attempts.

In the course of these two sieges the loss of the Spaniards was very considerable; that of 1705 costing them not less than 10,000 men, including those who died of sickness; and in that of 1727 their loss was computed at near 3000, besides casualties, which could not be ascertained. That of the garrison amounted in 1705 to 400; and in 1727 to 300; a very small number, considering that during the siege 70 cannon and 30 mortars burst on the batteries.

21 Gibraltar blocked up in 1779.

The hostile manifesto presented by the Spanish ambassador to the court of London at the commencement of the American war, was soon followed by an interruption of communication betwixt Spain and the fortress of Gibraltar. No direct intention of attacking or distressing it, however, was manifested till the 16th of July, when the port was completely blocked up by a squadron of two 74 gun ships, several frigates, galleys, &c. Ten days after they began to form a camp on the plain below St Roch, three miles from the fortress. The garrison at this time consisted of 5382 men, including officers, with a company of engineers and artificers; but the greatest expectations were formed from the abilities and valour of General Elliot the governor. As soon as the breaking off the communication with Spain indicated approaching hostilities, the governor took every precaution that could be suggested by military wisdom; but though informed of the rupture betwixt the two courts having actually taken place, and though he beheld the hostile operations of the enemy, no means were used to interrupt them till the 12th of September,

22 Hostilities commenced by the garrison.

when the batteries of Green's Lodge, Willis, and Queen Charlotte, were opened for a few hours, with a view to disturb the workmen.

From this time to the beginning of the year 1780 the enemy continued the blockade both by sea and land, but without doing any damage to the works or garrison, and it was not until the 12th of January

23 A woman first wounded in the fortress.

that a single person was wounded. This happened to be a woman, who, passing near one of the houses, was slightly hurt by a shot from the enemy. In the mean time, however, the usual supplies of provisions being cut off, the garrison began to feel all the horrors of famine. All the necessaries of life were very scarce,

24 Excessive dearness of provisions.

and to be procured only at exorbitant prices. Veal, mutton, and beef, sold from half a crown to four shillings per pound; fresh pork from two to three shillings; salted beef and pork fifteenpence; fowls eighteen shillings per couple; ducks a guinea; fire wood, five shillings per hundred weight; a pint of milk and water fifteenpence; a small cabbage cost five shillings, and a small bunch of outer leaves fivepence; Irish butter half a crown per pound; candles as much; and eggs sixpence each. As the rock, however, is almost surrounded by the sea, it was natural to suppose, that in such a scarcity of other provisions great benefit would have been derived from the ocean; but the fishermen, being all foreigners, and under no regulation, took advantage of the present scarcity of provisions in the garrison to exact a most exorbitant price for the fish they supplied.

25 The Spanish fleet defeated and their admiral taken by Rodney.

Had matters remained long in this state, it is plain that the fortress, however strong, must have fallen into the hands of the enemy. They were, however, effectually relieved in consequence of the victory gained by Admiral Rodney over the Spanish fleet commanded by Don Juan de Langara. The former had been furnished with a strong squadron, in order to relieve this important fortress; with which having set sail, he in a few days fell in with a Spanish fleet of 16 transports bound from Bilboa to Cadiz, and laden with provisions and naval stores, convoyed by a man of war of 64 guns, four frigates, and two armed vessels. Of these only a single transport escaped, the rest being all captured on the 8th of January 1780; and the loss of them, at the same time that it promised to be very serviceable to the garrison, was equally detrimental to the enemy, who were now in great want both of provisions and materials for their shipping.

This advantage was soon after followed by a much greater. On the 16th of the same month a Spanish squadron of 11 sail of the line was discovered off Cape St Vincent; and the British admiral having taken the proper methods to come up with them as quickly as possible, an engagement took place about four in the afternoon. At this time the headmost ships of the British line closed in with the nearest of the enemy, and in half an hour one of the Spaniards, mounting 70 guns, and having on board 600 men, blew up, and all on board perished. In two hours more another Spanish ship of the line was taken; notwithstanding which the fight continued with great vigour till two in the morning, when the headmost ship of the enemy struck to the Sandwich; after which the firing ceased. The weather throughout the night was so tempestuous that it was with the utmost difficulty the British could take possession of those ships which surrendered. These were six in number, but two of them drove ashore and were lost, only four being brought safe into Gibraltar. These were the admiral's ship of 80 guns and 700 men, with three others of 70 guns and 600 men. The engagement, however, happened so near the shore, and the British were so eager in securing the lee gage to prevent the enemy's escape, that Admiral Rodney's ship, together with some of the largest in the fleet, were in great danger of running on the shoals of St Lucar; nor

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nor could they be got into deep water again without much labour and the exertion of great naval skill. It was the opinion of all who were present in the action, that had this engagement happened in the day time, or had the weather been less boisterous, not one of the Spanish ships could have escaped; and even as it was, those which got off were so essentially damaged as to be unfit for service.

25 [Th]e garrison relieved and reinforced.

The news of this important victory arrived at Gibraltar on the evening of the day after it was fought; and in two days more the garrison was completely relieved by the arrival of the fleet and convoy, at the same time that they were farther reinforced by a regiment of Highlanders, consisting of 1051 men, officers included. An opportunity was also taken of sending away with the fleet all the invalids and women in the garrison; with whom they set sail on the 10th of February, leaving in the bay only the Edgar and Panther ships of the line, with two frigates.

On the departure of the British fleet, the blockade was immediately resumed; and notwithstanding the ample supplies lately received, the garrison soon began again to experience the inconveniency of wanting fresh provisions. It had hitherto received these in abundance from the coast of Barbary; but an unaccountable alteration had now taken place, so that the friendship of the emperor of Morocco was transferred from Great Britain to Spain in a manner totally unprecedented. His partiality towards the latter was the more surprising, as Britain had given no provocation, and the enmity between Spain and Morocco seemed to be in a manner constitutional, and founded upon such causes

[2]7 The garrison again reduced to straits.

as could never cease to operate. Thus, however, the garrison became daily more and more distressed, from being obliged to make constant use of their salt provisions, and even this with the strictest economy. The industry and resolution of the British seamen and officers, indeed, sometimes overcame all obstacles, so that they found means to procure the necessary refreshments; though in so doing they were certainly exposed to the utmost danger from the enemy. At the same time the defence of the garrison was so vigorous, that while it continued to be supplied even in this scanty manner, the Spaniards began to lose all hope of reducing it; for which reason they formed a project of burning

[2]8 Unsuccessful attempts to burn the British shipping.

all the British shipping in the bay. The night appointed for putting this scheme in execution was the 6th of June 1780, when 10 fire-ships, favoured by an uncommon darkness, stood over from the Spanish to the British side of the bay. Their design was to set fire to the storehouses nearest to the water side, as well as to the shipping there; but having been too precipitate in firing their ships, and being received also by a very heavy cannonade, the attempt was frustrated. On this occasion the skill and intrepidity of the British seamen were eminently displayed. Having manned their boats, they grappled the fire-ships already in flames; and, notwithstanding their dreadful appearance and the danger of their exploding, towed them clear of the vessels under the walls and extinguished them.

The failure of this project was a grievous disappointment to Don Barcelo the Spanish admiral, who lay ready with his squadron to intercept the British vessels that might attempt to escape; at the same time that the batteries on their lines were in readiness to bombard the town, if the fire-ships had succeeded in causing any conflagration on shore. The failure of the present attempt, however, was soon followed by other disasters. As soon as they had, with great labour, pushed forward their new works, and constructed new batteries, they were certainly destroyed by the besieged; and their mortification on these occasions was the greater, as it was usual for the governor to allow them to complete their works before he commenced his destructive operations. Thus the labour of many days was often lost in a few hours, and afterwards was to be resumed with as little prospect of success as before. The garrison was now considerably annoyed by the Spanish gun boats, to which indeed the shipping were equally exposed with themselves. These were vessels from 30 to 40 tons burden, constructed so that they lay low in the water, which rendered them difficult to be aimed at. They had 15 oars on a side, carried 40 or 50 men, with a 26 pounder on the prow; and from the facility of managing them, two were deemed, in calm weather, to be a match for a frigate of moderate size. All their efforts, however, could still do no more than to reduce the garrison to great straits for want of provisions; and to this dreadful inconvenience the British submitted with the greatest cheerfulness. From the time of Admiral Rodney's departure in the month of February 1780 to the month of October, almost the only provisions in the garrison were such as tended to produce the scurvy; which accordingly raged in such a manner, as to threaten the most fatal consequences. An antidote, however, was happily procured by the capture of a Danish dogger from Malaga laden with lemons and oranges, which the governor immediately purchased for the use of the garrison and distributed among them. "At this time (says Captain Drinkwater) the scurvy had made dreadful ravages in our hospitals, and more were daily confined: many however, unwilling to yield to its first attacks, persevered in their duty to the more advanced stages. It was therefore not uncommon, at this period, to see men, who, some months before, were hale, and capable of enduring any fatigue, supporting themselves to their posts upon crutches, and even with that assistance scarcely able to move along. The most fatal consequences in short were to be apprehended to the garrison from this terrible disorder, when this Dane was happily directed to our relief." According to Mr Cairncross, an eminent surgeon, who was present during this siege, "the scurvy which now raged in Gibraltar, differed in no respect from that disease usually contracted by sailors in long sea voyages; and of which the immediate cause seemed to be the subsisting for a length of time upon salted provisions only, without a sufficient quantity of vegetables or other acescent foods. The circumstances related in the voyage of that celebrated circumnavigator Lord Anson of consolidated fractures disuniting, and the callosity of the bone being perfectly dissolved, occured frequently in our hospitals, and old sores and wounds opened anew from the nature of the disorder. Various antiscorbutics were used without success, such as acid of vitriol, sour crout, extract of malt, essence of spruce, &c.; but the only specifics were fresh lemons and oranges given liberally; or, when they could not be

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29 Spanish works destroyed.

30 The garrison annoyed by the Spanish gun boats.

31 The scurvy rages in the garrison.

32 Cairncross's account of it.

Gibraltar. be procured, the preserved juice in such quantities, from one to four ounces per day, as the patient could bear. Whilst the lemons were sound, from one to three were administered each day as circumstances directed. The juice given to those in the most malignant state was sometimes diluted with sugar, wine, or spirits; but the convalescents took it without dilution. Women and children were equally affected; nor were the officers exempted from this dreadful disorder. It became almost general at the commencement of the winter season, owing to the cold and moisture, and in the beginning of spring when vegetables were scarce.

33 Method of preserving lemon juice. The juice was preserved by adding to 60 gallons of expressed liquor about five or ten gallons of brandy, which kept it in so wholesome a state, that several casks were opened in good condition at the close of the siege. The old juice, however, was not so speedily efficacious as the fruit, though by persevering longer in its use it seldom failed.

34 The garrison distressed for want of provisions. Till this month the allowance of salt provisions had continued undiminished; but now it was judged necessary to reduce the allowance of bread and meat, and to make some other regulations in order to enforce the strictest economy with regard to food. Every thing of this kind that could be practised, however, seemed insufficient to preserve the garrison from absolute want. In the beginning of the year 1781, provisions became exceedingly scarce, by reason of the almost total expenditure of what was contained in the public stores, and the vigilance of the enemy's cruisers. About the middle of February the town bakers left off work for want of flour; and many of the poorer sort wanted bread. The price of fresh provisions again rose to a most enormous height. Small pigs sold at two guineas; turkeys at three; geese at 30 shillings; fowls and ducks at 10 shillings; damaged biscuit a shilling the pound; pease 1s. 6d.; and all other necessaries in proportion; at the same time the scarcity of fuel was such, that it was sometimes scarcely procurable in quantity sufficient to dress the victuals.

35 The garrison entirely deprived of the use of the neutral ground. The garrison had hitherto derived assistance occasionally from the gardens on the neutral ground, though vast quantities of vegetables had been removed thence by the enemy. Towards the end of the month of October 1780, however, the Spaniards determined to expel the British from the gardens entirely: and this they accomplished in spite of all that could be done to prevent them. From this time the resources with regard to vegetables depended entirely upon the attention paid to cultivation; which, happily for the garrison, was attended with such success, especially during the winter months, that the produce came at last to be nearly equal to the demand.

36 Supplied by the British fleet. At last, on the 12th of April 1781, supplies were brought by the British fleet under Admirals Darby, Digby, and Ross, though they could not be got in without great difficulty. The gun boats already mentioned were now much increased in number and strength of construction; infesting the bay in such a manner as greatly to interrupt the debarkation of the stores. As no vessels of the same kind had been prepared to oppose them, they could scarce be prevented from effecting their purpose of burning the store ships. With this view they had approached them every morning in hazy weather to the number of between 20 and 30, several of them carrying mortar-pieces; and as they used both sails and oars, they eluded all pursuit, by withdrawing on the rise of any breeze. To keep off these troublesome guests, several stout frigates were obliged to station themselves along the bay for the protection of the shipping; but even this did not prevent them from continuing their molestation; and notwithstanding the vigilance and activity of the British sailors, it was seldom that they could come near enough to do them any damage. In spite of all their endeavours, however, the garrison was effectually relieved: an exploit which so exceedingly irritated the court of Spain, that they determined to exert the utmost force of the kingdom rather than fail in the execution of their favourite project.

37 The Spaniards resolve to exert themselves to the utmost. The works before the town were therefore carried on with more vigour than ever, and the most tremendous preparations made to cause the obstinate garrison feel the resentment of an exasperated enemy. Their batteries were now mounted with guns of the heaviest metal, and with mortar-pieces of the largest size; the number of the former augmented to near 200, and of the latter to upwards of 80. For three weeks this prodigious artillery continued to pour forth an almost incessant shower of shot and shells, insomuch that, in the time just mentioned, they had consumed 100,000lb. of gunpowder, and thrown into the town four or five thousand shot or shells every 24 hours.

38 The town entirely destroyed. By such an immense bombardment the town was almost totally laid in ruins. The inhabitants, computed at more than 3000 in number, experienced every difficulty that could arise from the destruction of their habitations: several of them were killed, and all forced to leave the town, and take shelter under tents with what accommodation could be provided for them in such scenes of horror and confusion. Numbers took the opportunity of retiring with the fleet; while many that remained were now reduced from a state of opulence to the greatest distress. The conduct of Governor Elliot was very humane and compassionate to such as were inclined to depart; allowing them a free passage to England, and supplying them with provisions for the voyage.

39 Disorderly behaviour of the soldiers. During this bombardment, not only the greatest part of the effects belonging to the inhabitants were destroyed, but the fortifications were in many places greatly injured; and the worst was, that the remainder were destroyed by the soldiers, who had arrived at such a pitch of licentiousness, that they neither regarded nor would obey their officers. They were incited to this destructive scheme by the avarice of some of the inhabitants who had hoarded up and concealed a quantity of necessary articles, in order to procure an advanced price. They now, therefore, kept no bounds in dissipation, waste, and extravagance; a remarkable instance of which is given by Captain Drinkwater, in their roasting a pig by a fire made of cinnamon. To put a stop to these atrocious proceedings, rigorous measures were of necessity adopted; and it was intimated, that any soldier convicted of being drunk or asleep upon his post, or found marauding, should be immediately executed. The loss of human lives during this dreadful bombardment was less than could have been expected; but many remarkable circumstances are taken notice

braltar. notice of by Captain Drinkwater, some of which are related in the note (B).

By the beginning of June 1781, the enemy had relaxed considerably in their firing, seldom exceeding 600 shot in a day; and continued gradually to diminish this number so remarkably, that towards the end of August, they seldom fired in the day, and only discharged six or seven, and sometimes not above three, shot in the night. The batteries at land, however, were succeeded by the gun-boats; which renewed their attacks every day, keeping the garrison in continual alarm, and never failing to do more or less execution. To restrain them, therefore, a battery of guns capable of throwing their shot to a great distance was erected as near as possible to the enemy; and as it reached their very camp, it was determined to open it upon them as often as the gun boats made their attacks; which being soon perceived, they thought it prudent to desist in some measure from that mode of hostility.

40 e works he ene- brought the ut- st per- tion.

They continued still, however, to improve their works, and for this purpose employed the best engineers both of France and Spain; so that by the latter part of November 1781, they had brought them to such a state of perfection as filled both kingdoms with the most sanguine expectations of success. Governor Elliot, however, far from being dismayed at these formidable bulwarks, suffered them to proceed without molestation to the end of their scheme, that he might as in a moment destroy the labour of so many months, and thus render the disappointment the greater.

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41 They are entirely destroyed.

In the night of the 27th of November, a chosen party of 2000 men was detached, in order to destroy the enemy's works and batteries; and their success was equal to their most sanguine expectations. They marched out in great order and silence about two o'clock in the morning, under the command of Brigadier General Ross; after which they proceeded with the same circumspection, but with the utmost celerity, to the enemy's works, which they stormed and overthrew with astonishing rapidity. The Spaniards were instantly thrown into confusion, and fled on every side; the guns and mortars on the batteries were all spiked up; and

(B) Two boys belonging to the artificer company were endowed with such wonderful strength of vision, that they could see the shot of the enemy in the air almost as soon as it came from the mouth of the gun; and were therefore constantly placed upon some part of the works to give notice to the soldiers of the approaching danger. During the time of the hottest fire, however, the men were so habituated to the fall of shells and shot around them, that they contracted an insensibility of danger, and almost required to be cautioned by their officers to avoid the explosion of a shell when lying with the fusee burning at their feet. In consequence of this inattention, they frequently neglected the advice of the boys above mentioned, and their neglect could not but be productive of fatal effects. An instance of this happened on the Princess Amelia's battery, where a shot thus disregarded came through one of the capped embrasures, carried off one leg from each of three soldiers, and wounded a fourth in both. In other cases, in which the persons themselves have observed the shot or shells coming towards them, they have been fascinated by its appearance, and unable to move from the spot, as small birds are said to be by the rattlesnake. "This sudden arrest of the faculties (says our author) was nothing uncommon: several instances occurred to my own observation, where men, totally free, have had their senses so engaged by a shell in its descent, that though sensible of their danger, even so far as to cry for assistance, they have been immoveably fixed to the place. But what is more remarkable, these men have so instantaneously recovered themselves on its fall to the ground, as to remove to a place of safety before the shell burst." In this manner Lieutenant Lowe of the 12th regiment was fascinated by a shot which he saw coming, but had not power to remove from the place before it fell upon him and took off his leg.

Where these shells burst they produced instant and certain destruction, mangling in the most dreadful manner. The following are some instances: A matross had the misfortune of breaking his thigh by some accident; and being a man of great spirit, could scarce bear the confinement necessary for its reunion. In consequence of this he went abroad too soon, and thus unfortunately broke the bone a second time. Being now confined to bed, a shell happened to fall into the room where he was, and, rebounding, lodged itself directly upon him. The convalescents and sick instantly summoned all their strength, and crawled out of the room, while the poor matross lay below the shell, kept down by its weight, and utterly unable to stir. In a few seconds it burst, and took off both his legs, and scorched him in a dreadful manner. He survived the explosion, was sensible to the last moment, and died regretting that he had not been killed on the batteries. The case of a soldier of the 73d regiment shows, that even in the most dangerous cases we should never despair of recovery while life remains. This unfortunate man had been knocked down by the wind of a shell, which, instantly bursting, killed his companion, and mangled himself in a shocking manner. His skull was dreadfully fractured, his left arm broken in two places, one of his legs shattered, the skin and muscles torn off from part of his right hand, the middle finger broken to pieces, and his whole body most severely bruised and marked with gunpowder. He presented so horrid an object to the surgeons, that they had not the least hopes of saving his life, and were at a loss what part to attend to first. He was that evening trepanned; a few days afterwards his leg was amputated, and other wounds and fractures were dressed. Being possessed of a most excellent constitution, nature performed wonders in his favour, and in 11 weeks his cure was completely effected. On the 18th of September a shell from the lines fell into a house where the town major, Captain Burke, with Majors Mercier and Vignoles of the 39th regiment were sitting. It took off Major Burke's thigh; afterwards fell through the floor into the cellar: there it burst, and forced the flooring with the unfortunate major up to the ceiling. When assistance came, they found him almost buried in the ruins of the room. He was instantly conveyed to the hospital, where he died soon after the wounded part had been amputated. Majors Mercier and Vignoles

Gibraltar. and the artillerymen, artificers, and sailors, exerted themselves so vigorously, that in the space of an hour the magazines were blown up, the storehouses of arms, ammunition, and military implements of every kind, and all the works that had been constructed, were set on fire, and totally consumed; the whole damage done on this occasion being estimated at upwards of two millions sterling.

For several days after this disaster the Spaniards continued inactive, without even making any attempt to extinguish their batteries, which still continued in flames; but in the beginning of December, as if suddenly aroused from their reverie, upwards of 1000 men were set to work in order to prepare a great number of fascines, from whence it was concluded that they designed to repair their works. In this they proceeded with their usual perseverance and diligence; but as the former methods of attack had constantly failed, it was evident, that if the place could be reduced at all, it must be by some means hitherto unattempted; and for the reduction of this single fortress, the Spanish monarch, after the conquest of Minorca, determined to employ the whole strength of his empire.

42 Floating batteries invented by the chevalier D'Arcon.

Among the various projects formed at this time, that of the chevalier D'Arcon, a French engineer of distinction, proved the most acceptable to the court of Spain; and though the expence attending it was immense, this seemed in the present circumstances to be but a matter of small consideration. His plan was to construct such floating batteries as might neither be liable to be sunk nor set on fire. With this view their bottoms were made of the thickest timber, and their sides of wood and cork long soaked in water, with a layer of wet sand betwixt them. Their thickness was such, that they were impenetrable to cannon shot; and to prevent the effects of red-hot balls, a number of pipes were contrived to carry water through every part of the vessel, and pumps sufficient to furnish a constant supply for the purpose. The people at the batteries were sheltered from the bombs by a rope-netting, made sloping that they might roll off, and spread with wet skins to prevent fire. Ten of these batteries were constructed out of the hulls of large vessels, some of 50 or 60 guns, cut down for that purpose, and carrying from 10 to 28 guns each, with about half as many in reserve in case of accidents. Each gun was served by 36 artillery men; and these floating batteries were to be seconded by 80 large boats carrying guns and mortars of heavy metal; a great number of ships of force and frigates, with some hundreds of small craft, were to accompany them with troops, for the instant execution of what might be judged necessary. On this occasion upwards of 1000 pieces of artillery, and 80,000 barrels of gunpowder were provided. A body of 12,000 of the best troops of France were now added to the Spanish army before the place; the body of engineers was the best that both kingdoms could produce; and numbers of volunteers, of the best families in both, attended the siege. Numbers of military gentlemen also came from every part of Europe to be witnesses of what passed at this celebrated siege, which was now compared to the most famous recorded in history. The conducting of it was committed to the duke de Crillon, who had distinguished himself by the conquest of Minorca. Two princes of the blood royal of France, the count of Artois brother to the king, and the duke of Bourbon his cousin, came to be witnesses of this extraordinary enterprise. These behaved with the greatest politeness both to the governor and garrison. The count of Artois transmitted a packet of letters for various individuals in the garrison, which had been intercepted and carried to Madrid, and which he requested that he might be the means of conveying to those for whom they were designed. Both he and the duke of Bourbon signified to General Elliot the high regard they had for his person and character; and the duke de Crillon himself took this opportunity of expressing the same sentiments, and to entreat him to accept of some refreshments. General Elliot returned a polite answer, but accepted of the present with reluctance, and requested him for the future not to confer any favours of that kind upon him.

43 Prodigious armament brought before the fortress.

Such a prodigious armament raised the confidence of the besiegers so high, that they looked upon the conquest

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Vignoles had time to escape before the shell burst; nevertheless they were slightly wounded by the splinters, as were a serjeant and his daughter who happened to be in the cellar when the shell entered.

The following are related as instances of very extraordinary escapes from the destructive power of these engines, and which indeed it seems difficult to account for.—A corporal had the muzzle of his firelock closed, and the barrel twisted like a French horn, by a shell, without any injury to his person. A shell happened to fall into a tent where two soldiers were asleep, without awakening them by its fall. A serjeant in an adjacent tent heard it, and ran near 40 yards to a place of safety, when he recollected the situation of his comrades. Thinking the shell had fallen blind, he returned and awakened them; both immediately rose, but continued by the place, debating on the narrow escape they had had, when the shell exploded, and forced them with great violence against a garden wall, but "miraculously" did no further mischief than destroying every thing in the tent. On the new year's day of 1782, an officer of artillery observed a shell falling towards the place where he stood, and got behind a traverse for protection. This he had scarcely done, when the shell fell into the traverse, and instantly entangled him in the rubbish: one of the guards, named *Martin*, observing his distress, generously risked his own life in defence of his officer, and ran to extricate him: but finding his own efforts ineffectual, called for assistance; when another of the guard joining him, they relieved the officer from his situation; and almost at the same instant the shell burst, and levelled the traverse with the ground. Martin was afterwards promoted, and rewarded by the governor; who at the same time told him, that "he should equally have noticed him for attending to his comrade." A shell happening to fall into the room where Ensign Mackenzie of the 73d regiment was sitting, carried away part of his chair, and fell into the room below, where it burst, lifting him and the chair from the floor without further injury.

Gibraltar. conquest of the place as an absolute certainty. They began to be impatient at the delays which arose in bringing matters to the utmost point of perfection; and the commander in chief was thought by far too modest, when he said that the garrison might hold out for a fortnight. "It appeared (says Captain Drinkwater) that they meant, previous to their final efforts, to strike if possible a terror through their opponents, by displaying an armament more powerful than had probably ever been brought before any fortress. Forty-seven sail of the line, including three inferior two-deckers; ten battering ships, deemed perfect in design, and esteemed invincible, carrying 212 guns; innumerable frigates, xebeques, bomb ketches, cutters, gun and mortar boats, and smaller craft for disembarking men, were assembled in the bay. On the land side were most stupendous and strong batteries and works, mounting 200 pieces of heavy ordnance, and protected by an army of near 40,000 men, commanded by a victorious and active general, and animated by the immediate presence of two princes of the blood royal of France, with other dignified personages, and many of their own nobility. In their certainty of success, however, the enemy seemed entirely to have overlooked the nature of that force which was opposed to them; for though the garrison scarcely consisted of more than 7000 effective men, including the marine brigade, they forgot that they were now veterans in this service, had long been habituated to the effects of artillery, and were by degrees prepared for the arduous conflict that awaited them. We were at the same time commanded by officers of approved courage, prudence, and activity; eminent for all the accomplishments of their profession, and in whom we had unbounded confidence. Our spirits too were not a little elevated by the success attending the firing of red-hot shot (c), which in this attack we hoped would enable us to bring our labours to a conclusion, and relieve us from the tedious cruelty of a vexatious blockade."

As a prelude to the dreadful storm which was about to be poured forth on this devoted garrison, the enemy, on the 9th of September 1782, opened a battery of 64 of their largest cannon, which was shortly accompanied with a terrible fire from other batteries, and a great number of mortars. On this and the following day an attack was made upon the batteries erected on Europa Point (so called from being the most southerly point of the continent of Europe), which at that time were entirely under the management of Captain Curtis of the Brilliant frigate, who had distinguished himself during the siege, and now commanded a brigade of seamen by whom the batteries were served. By these the fire of the Spaniards was so warmly returned, that they not only could make no impression, but were forced to retire, after having received so much damage, that two of their principal ships were obliged to withdraw to the bay of Algesiras opposite to Gibraltar, in order to refit. On the 12th the enemy made preparations for the ensuing day, which was allotted for their grand and decisive attack. Accordingly, on the morning of the 13th, the ten floating batteries came forward, under the command of Don Buenventura de Moreno, a Spanish officer of great gallantry, and who had signalized himself at the taking of Minorca. Before ten o'clock they had all got into their proper stations, anchoring in a line about a thousand yards distant from the shore. As soon as they were properly arranged, they began a heavy cannonade, and were seconded by all the cannon and mortars in the enemy's lines and approaches, at the same time that the garrison opened all its batteries both with hot and cold shot from the guns, and shells from the howitzers and mortars. This terrible fire continued on both sides without intermission until noon; when that of the Spaniards began to slacken, and the fire of the garrison to obtain a superiority. About two o'clock the principal battering ship commanded by Don Moreno was observed to emit smoke as if on fire, and some men were seen busy upon the roof searching from whence it proceeded. The fire from the garrison was now kept up without the least discontinuance or diminution, while that from the floating batteries was perceived sensibly to decrease; so that about seven in the evening they fired but few guns, and that only at intervals. At midnight the admiral's ship was plainly seen to burn, and in an hour after was completely in flames. Eight more of these batteries took fire successively; and on the signals of distress made by them, the multitude of feluccas, launches, and boats, with which they were surrounded, all came to their assistance, and began to take the men out of the burning vessels. Captain Curtis, who lay ready with the gunboats to take advantage of any favourable circumstance, came upon them at two in the morning, and forming a line on the enemy's flank, advanced upon them with such order and expedition as to throw them into immediate confusion. At this sudden and unexpected attack they were so astonished and disconcerted, that they fled precipitately with all their boats, totally abandoning the floating batteries to be burnt, and all who were in them to perish in the flames. This would undoubtedly have been their fate, had not Captain Curtis extricated them from the fire at the imminent danger of his own life and that of his men. In this work he was so eager, that while his boat was alongside of one of the largest batteries, it blew up, and the fragments of the wreck spreading all around to a vast distance, some heavy pieces of timber fell into his boat and pierced through its bottom, killing one man and wounding several others. He escaped with difficulty out of this boat, which was sunk, as well as another, by the same accident. The floating batteries were every one consumed; and the violence with which they exploded was such, that doors and windows at a great distance on shore were burst open. About 400 people were saved from them; many of whom were picked up floating on rafts and pieces of timber. Indeed the blowing up of the

Gibraltar.

44 Decisive attack on the 13th of September 1782.

45 Terrible destruction of the Spaniards.

(c) This was suggested by Lieutenant Governor Boyd, and had been attended with remarkable success, September 8th, when the enemy's advanced works were almost destroyed by it.

the batteries as the flames reached their powder rooms, and the discharge of the guns in succession as the metal became heated by the fire, rendered any attempt to save them very dangerous.

46 Inactivity of the combined fleet.

This terrible catastrophe took place in sight of the combined fleets of France and Spain. It had been proposed that they should co-operate upon this important occasion, by attacking the garrison at Europa Point, and such places as appeared most exposed to an attempt by sea. This, it was afterwards said, must have occasioned a material diversion of the garrison's force, and, by dividing it, have weakened considerably the vigorous means of defence used in those parts which were actually attacked. The reason assigned for this inactivity was the want of wind.

47 The blockade continued.

Though this terrible repulse effectually convinced the Spaniards that Gibraltar could not be taken by force, some hope still remained, that, without any further exertions on their part, the garrison would be obliged to surrender from want of ammunition and provisions. With this view they continued to blockade it closely, and to cut off all communication, flattering themselves that Britain would not be able to collect a naval force sufficient to drive their fleet from the bay before the fortress was reduced to extremity; and this they imagined must be the case in a few days. Such diligence, however, had been used on the part of the British, that a fleet was already assembled at Portsmouth, consisting of 35 sail of the line, in excellent condition, and filled with the best officers and sailors in Europe. The command was given to Lord Howe, who was accompanied in the expedition by Admirals Barrington, Milbank, Hood, Sir Richard Hughes, and Commodore Hotham, all of them men eminent in their profession. At the same time also it fortunately happened, that a large British fleet of merchantmen had just arrived in safety from the Baltic; and that a Dutch squadron which had been cruising on their own coasts, not being able to penetrate southwards in order to join the French, had retired into port, and given up the intention of effecting any junction for that season.

At this time the British nation was in the utmost anxiety about the fate of Gibraltar. The progress of the ships was delayed by contrary winds, and it was not until they had gained the southern coast of Portugal that they received information of the defeat of the enemy's attempt on the 13th of September. On the 11th of October, Lord Howe entered the Straits, and several of the store ships destined for Gibraltar came safe to anchor under the cannon of the fort without any molestation from the enemy. The combined fleet in the mean time had been much damaged by a storm; two ships of the line were driven ashore near Algesiras; two more were driven out of the bay into the Mediterranean; others lost their masts, and most of them suffered considerably. One in particular, a ship of 70 guns, was carried by the storm across the bay, and ran aground under the works of Gibraltar, where she was taken by the garrison, with her whole complement of men, consisting of 700. Notwithtanding the endeavours of the enemy to destroy her, she was safely got off, and properly repaired. The combined fleet, however, put to sea on the 13th, with a view to prevent the remaining storeships that had overshot the bay to the east from making good their entrance into it; and at the same time to rejoin the two ships that had been separated from the main body by the storm. Having the advantage of the wind, they bore down upon the British fleet, which drew up in order of battle to receive them; but notwithstanding their superiority, they declined coming to an engagement. On the wind becoming more favourable next day, Lord Howe took the opportunity to bring in the storeships that were in company; and the day following the remainder were conveyed to Gibraltar, the troops for the reinforcement of the garrison were landed, with a large supply of powder, and ample provision in every other respect. As they returned through the Straits they were threatened with an engagement by the combined fleets; but though the latter had a superiority of 12 ships of the line, they kept a wary distance. Some firing indeed took place, but it was attended with little effect on either side.

48 The garrison finally relieved.

This last relief proved entirely decisive; for though the blockade continued till news arrived of the preliminaries of peace being signed, in the beginning of February, 1783, no other attack was made. The news of the pacification was received with the utmost joy by the Spaniards. Mutual civilities passed between the commanders in chief, and the Duke de Crillon paid many handsome compliments to the governor and garrison for their noble defence; declaring that he had exerted himself to the utmost of his abilities, and though he had not proved successful, yet he was happy in having his sovereign's approbation of his conduct.

49 Importance of Gibraltar.

The possession of Gibraltar is esteemed of very great consequence to Britain. It not only gives us the command of the Straits, and their navigation; but affords refreshment and accommodation to our fleets in time of war, and to our merchantmen at all times; which, to a maritime power, is of very great advantage. From its situation, it divides both the kingdoms of France and Spain; that is, it hinders a ready communication by sea between the different parts of these kingdoms. This, of course, hinders the conjunction of their fleets and squadrons with each other, or at least renders it so difficult as to be a perpetual check upon these ambitious powers. It awes also the piratical states of Barbary, and in like manner the emperor of Morocco; insomuch, that our commerce is more safe than that of any other European power, which gives us great advantages in point of freight. It is otherwise highly favourable to our trade in the Mediterranean and Levant. It procures us the respect of the Italian and other powers; who, though far distant from Britain, must consider this as an instance of her power to hurt or assist them. It also saves us the expence of squadrons or convoys, upon any disputes or disturbances that may happen among these powers, and which would otherwise be necessary for the protection of our navigation.

"The form of this mountain is (says Major Imrie) oblong; its summit a sharp craggy ridge; its direction is nearly from north to south; and its greatest length, in that direction, falls very little short of three miles. Its breadth varies with the indentations of the shore, but it nowhere exceeds three quarters of a mile. The line of its ridge is undulated, and the two extremes are somewhat higher than its centre.

50 Natural history.

"The summit of the Sugar Loaf, which is the point of of its greatest elevation towards the south, is 1439 feet; the Rock Mortar, which is the highest point to the north, is 1350; and the Signal House, which is nearly the central point between these two, is 1276 feet above the level of the sea. The western side of the mountain is a series of rugged slopes, interspersed with abrupt precipices. Its northern extremity is perfectly perpendicular, except towards the north-west, where what are called the Lines intervene, and a narrow passage of flat ground that leads to the isthmus, and is entirely covered with fortification. The eastern side of the mountain mostly consists of a range of precipices; but a bank of sand, rising from the Mediterranean in a rapid acclivity, covers a third of its perpendicular height. Its southern extremity falls, in a rapid slope from the summit of the Sugar Loaf, into a rocky flat of considerable extent, called Windmill hill.

"The principal mass of the mountain rock consists of a gray, dense (what is generally called primary) marble; the different beds of which are to be examined in a face of 1350 feet of perpendicular height, which it presents to Spain in a conical form. These beds, or strata, are of various thickness, from 20 to upwards of 40 feet, dipping in a direction from east to west, nearly at an angle of 35 degrees. In some parts of the solid mass of this rock are found testaceous bodies entirely transmuted into the constituent matter of the rock, and their interior hollows filled up with calcareous spar; but these do not often occur in its composition, and its beds are not separated by any intermediate strata.

"The caves of Gibraltar are many, and some of them of great extent. That which most deserves attention and examination is called St-Michael's Cave, which is situated upon the southern part of the mountain, almost equally distant from the Signal Tower, and the Sugar Loaf. Its entrance is 1000 feet above the level of the sea: This entrance is formed by a rapid slope of earth, which has fallen into it at various periods, and which leads to a spacious hall, incrusted with spar, and apparently supported in the centre by a large massy stalactitical pillar. To this succeeds a long series of caves of difficult access. In these cavernous recesses, the formation and process of stalactites is to be traced, from the flimsy quilt-like cone, suspended from the roof, to the robust trunk of a pillar, three feet in diameter, which rises from the floor, and seems intended by Nature to support the roof from which it originated.

"The only inhabitants of these caves are bats, some of which are of a large size. The soil, in general, upon the mountain of Gibraltar is but thinly sown; and in many parts that thin covering has been washed off by the heavy autumnal rains, which have left the superficies of the rock, for a considerable extent, bare and open to inspection. In those situations, an observing eye may trace the effects of the slow, but constant, decomposition of the rock, caused by its exposure to the air, and the corrosion of sea-salts, which, in the heavy gales of easterly winds, are deposited with the spray on every part of the mountain. Those uncovered parts of the mountain rock also expose to the eye a phenomenon worthy of some attention, as it tends clearly to demonstrate, that, however high the surface of this rock may now be elevated above the level of the sea, it has once been the bed of agitated waters. This phenomenon is to be observed in many parts of the rock, and is constantly found in the beds of torrents. It consists of pot-like holes, of various sizes, hollowed out of the solid rock, and formed apparently by the attrition of gravel or pebbles, set in motion by the rapidity of rivers or currents in the sea.

"Upon the west side of the mountain, towards its base, some strata occur, which are heterogeneal to the mountain rock: the first, or highest, forms the segment of a circle; its convex side is towards the mountain, and it slopes also in that direction. This stratum consists of a number of thin beds; the outward one, being the thinnest, is in a state of decomposition, and is mouldering down into a blackish brown or ferruginous coloured earth. The beds, inferior to this, progressively increase in breadth to 17 inches, where the stratification rests upon a rock of an argillaceous nature.

"This last bed, which is 17 inches thick, consists of quartz of a blackish blue colour, in the septa or cracks of which are found fine quartz crystals, colourless, and perfectly transparent. These crystals are composed of 18 planes, disposed in hexangular columns, terminated at both extremities by hexangular pyramids. The largest of those that Major Imrie saw did not exceed one-fourth of an inch in length: They, in general, adhere to the rock by the sides of the column, but are detached without difficulty. Their great degree of transparency has obtained them the name of *Gibraltar diamonds*.

51 Bones found in fissures of the rock.

"In the perpendicular fissures of the rock, and in some of the caverns of the mountain (all of which afford evident proofs of their former communication with the surface), a calcareous concretion is found, of a reddish brown ferruginous colour, with an earthy fracture, and considerable induration, inclosing the bones of various animals, some of which have the appearance of being human. These bones are of various sizes, and lie in all directions, intermixed with shells of snails, fragments of the calcareous rock, and particles of spar; all of which materials are still to be seen in their natural uncombined states, partially scattered over the surface of the mountain. These have been swept, by heavy rains at different periods, from the surface into the situations above described, and having remained for a long series of years in those places of rest, exposed to the permeating action of water, have become enveloped in, and cemented by, the calcareous matter which it deposits.

"The bones, in this composition, have not the smallest appearance of being petrified; and if they have undergone any change, it is more like that of calcination than that of petrifaction, as the most solid parts of them generally admit of being cut and scraped down with the same ease as chalk.

"Bones combined in such concretions are not peculiar to Gibraltar: they are found in such large quantities in the country of Dalmatia and upon its coasts, in the islands of Cherso and Osero, that some naturalists have been induced to go so far as to assert, that there has been a regular stratum of such matter in that country, and that its present broken and interrupted appearance has been caused by earthquakes, or other convulsions, experienced in that part of the globe. But, of late years, a traveller (Abbé Alberto Fortis) has given a minute description of the concretion in which the bones are found in that country: And by his account it appears, that with regard to situation, composition, and colour, Gibraltar.

colour, it is perfectly similar to that found at Gibraltar. By his description, it also appears that the two mountain rocks of Gibraltar and Dalmatia consist of the same species of calcareous stone; from which it is to be presumed, that the concretions in both have been formed in the same manner and about the same periods.

" Perhaps if the fissures and caves of the rocks of Dalmatia were still more minutely examined, their former communications with the surface might yet be traced, as in those described above; and, in that case, there would be at least a strong probability, that the materials of the concretions of that country have been brought together by the same accidental cause which has probably collected those found in the caverns of Gibraltar. Major Imrie traced, in Gibraltar, this concretion, from the lowest part of a deep perpendicular fissure, up to the surface of the mountain. As it approached to the surface, the concretion became less firmly combined, and, when it had no covering of the calcareous rock, a small degree of adhesion only remained, which was evidently produced by the argillaceous earth, in its composition, having been moistened by rain and baked by the sun.

" The depth at which these materials had been penetrated by that proportion of stalactitical matter, capable of giving to the concretion its greatest adhesion and solidity, he found to vary according to its situation, and to the quantity of matter to be combined. In fissures, narrow and contracted, he found the concretion possessing a great degree of hardness at six feet from the surface; but in other situations more extended, and where a larger quantity of the materials had been accumulated, he found it had not gained its greatest degree of adhesion at double that depth. In one of the caves, where the mass of concretion is of considerable size, he perceived it to be divided into different beds, each bed being covered with a crust of the stalactitical spar, from one inch to an inch and a half in thickness, which seems to indicate, that the materials have been carried in at various periods, and that those periods have been very remote from each other.

" At Rosia bay, upon the west side of Gibraltar, this concretion is found in what has evidently been a cavern, originally formed by huge unshapely masses of the rock which have tumbled in together. The fissure, or cavern, formed by the disruption and subsidence of those masses, has been entirely filled up with the concretion, and is now exposed to full view by the outward mass having dropped down in consequence of the encroachments of the sea. It is to this spot that strangers are generally led to examine the phenomenon; and the composition having here attained to its greatest degree of hardness and solidity, the hasty observer, seeing the bones inclosed in what has so little the appearance of having been a vacuity, examines no further, but immediately adopts the idea of their being incased in the solid rock. The communication from this former chasm, to the surface from which it has received the materials of the concretion, is still to be traced in the face of the rock, but its opening is at present covered by the base of the line wall of the garrison. Here bones are found that are apparently human; and those of them that appear to be of the legs, arms, and vertebræ of the back, are scattered among others of various kinds and sizes, even down to the smallest bones of small birds. Major Imrie found here the complete jaw-bone of a sheep; it contained its full complement of teeth, the enamel of which was perfect, and its whiteness and lustre in no degree impaired. In the hollow parts of some of the large bones was contained a minute crystallization of pure and colourless calcareous spar; but, in most, the interior part consisted of a sparry crust of a reddish colour, scarcely in any degree transparent.

" At the northern extremity of the mountain, the concretion is generally found in perpendicular fissures. The miners there employed upon the fortifications, in excavating one of those fissures, found at a great depth from the surface, two skulls, which were supposed to be human; but, to the Major, one of them, if not both, appeared to be too small for the human species. The bone of each was perfectly firm and solid; from which it is to be presumed, that they were in a state of maturity before they were inclosed in the concretion. Had they appertained to very young children, perhaps the bone would have been more porous, and of a less firm texture. The probability is, that they belonged to a species of monkey, which still continues to inhabit, in considerable numbers, those parts of the rock which are to us inaccessible.

" This concretion varies, in its composition, according to the situation in which it is found. At the extremity of Prince's Lines, high in the rock which looks towards Spain, it is found to consist only of a reddish calcareous earth, and the bones of small birds cemented thereby. The rock around this spot is inhabited by a number of hawks, that, in the breeding season, nestle here and rear their young; the bones in this concretion are probably the remains of the food of those birds. At the base of the rock, below King's Lines, the concretion consists of pebbles of the prevailing calcareous rock. In this concretion, at a very considerable depth under the surface, was found the under parts of a glass bottle, uncommonly shaped, and of great thickness; the colour of the glass of a dark green *."

* *Phil. Trans.* vol. iv. 52

Subterraneous galleries.

" The subterranean galleries are very extensive, pierce the rock in several places and in various directions, and at various degrees of elevation; all of them have a communication with each other, either by flights of steps cut in the rock, or by wooden stairs where the passages are required to be very perpendicular.

" The centinels may now be relieved during a siege from one post to another in perfect safety; whereas, previously to the constructing of these galleries a vast number of men were killed by the Spaniards while marching to their several stations. The width of these galleries is about twelve feet, their height about fourteen. The rock is broken through in various places, both for the purpose of giving light and for placing the guns to bear on the enemy. In different parts there are spacious recesses, capable of accommodating a considerable number of men. To these recesses they give names, such as St Patrick's Chamber, St George's Hall, &c. The whole of these singular structures have been formed out of the solid rock by blasting with gunpowder. Through the politeness of an officer on duty, a place called Smart's Reservoir was opened for our inspection, which is a great curiosity, and not generally permitted to be shewn. It is a spring at a considerable depth in the body of the rock, and is above 700 feet above the level of the sea; we descended into the cavern that contains

Gibraltar, Gibson. tains it by a rope ladder, and with the aid of lighted candles proceeded through a narrow passage over crystallized protuberances of the rock till we came to a hollow, which appears to have been opened by some convulsion of nature. Here, from a bed of gems, arises the salutary fount, clear as the brilliant of the east, and cold as the icicle. We hailed the nymph of the grot, and, prostrating ourselves, quaffed hygean nectar from her sparry urn. When restored to the light of day, we obtained, through the medium of the same gentleman, the key of St George's Hall, at which we arrived by a very intricate and gloomy path to the spacious excavation, which is upwards of a hundred feet in length, its height nearly the same. It is formed in a semicircular part of the rock; spacious apertures are broken through, where cannons of a very large calibre command the isthmus, the Spanish lines, and a great part of the bay. The top of the rock is pierced through, so as to introduce sufficient light to enable you to view every part of it. It appears almost incredible that so large an excavation could be formed by gunpowder, without blowing up the whole of that part of the rock, and still more so, that they should be able to direct the operations of such an instrument, so as to render it subservient to the purpose of elegance. We found in the hall a table, placed, I suppose, for the conveniency of those who are traversing the rock. The cloth was spread, the wine went round, and we made the vaulted roof resound with the accents of mirth and the songs of conviviality *."

* Month. Mag. 1798.

GIBSON, Richard, an English painter, commonly called the *Dwarf*, was originally page to a lady at Mortlake; who, observing that his genius led him to painting, had the generosity to get him instructed in the rudiments of that part. He devoted himself to Sir Peter Lely's manner, and copied his pictures to admiration, especially his portraits: his paintings in water colours were also esteemed. He was in great favour with Charles I. who made him his page of the back stairs; and he had the honour to instruct in drawing Queen Mary and Queen Anne when they were princesses. He married one Mrs Anne Shepherd, who was also a dwarf; on which occasion King Charles I. honoured their marriage with his presence, and gave away the bride. Mr Waller wrote a poem on this occasion, entitled "The Marriage of the Dwarfs;" in which are these lines:

Design or chance makes others wive,
But nature did this match contrive;
Eve might as well have Adam fled,
As she deny'd her little bed
To him for whom heav'n seem'd to frame
And measure out this only dame."

Mr Fenton, in his notes on this poem, observes that he had seen this couple painted by Sir Peter Lely; and that they were of an equal stature, each being three feet ten inches high. They had nine children, five of whom arrived at maturity; these were well proportioned, and of the usual standard of mankind. But what nature denied this couple in stature, she gave them in length of days: for Mr Gibson died in the 75th year of his age; and his wife, having survived him almost 20 years, died in 1709, aged 89.

GIBSON, *Dr Edmund*, bishop of London, was born in Westmoreland, in 1699. He applied himself early and vigorously to learning, and displayed his knowledge in several writings and translations, which recommended him to the patronage of Archbishop Tennison. He was appointed domestic chaplain to his Grace; and we soon after find him rector of Lambeth, and archdeacon of Surry. Becoming thus a member of the convocation, he engaged in a controversy, which was carried on with great warmth by the members of both houses, and defended his patron's rights, as president, in eleven pamphlets; he then formed and completed his more comprehensive scheme of the legal duties and rights of the English clergy, which was at length published under the title of *Codex Juris Ecclesiastici Anglicani*, in folio. Archbishop Tennison dying in 1715, and Dr Wake bishop of Lincoln being made archbishop of Canterbury, Dr Gibson succeeded the latter in the see of Lincoln, and in 1720 was promoted to the bishopric of London. He now not only governed his diocese with the most exact regularity, but by his great care promoted the spiritual affairs of the church of England colonies in the West Indies. He was extremely jealous of the least of the privileges belonging to the church; and therefore, though he approved of the toleration of the Protestant Dissenters, he continually guarded against all the attempts made to procure a repeal of the corporation and test acts; in particular, his opposition to those licentious assemblies called *masquerades*, gave great umbrage at court, and effectually excluded him from all further favours. He spent the latter part of his life in writing and printing pastoral letters, visitation-charges, occasional sermons, and tracts against the prevailing immoralities of the age. His pastoral letters are justly esteemed as the most masterly productions against infidelity and enthusiasm. His most celebrated work, the *Codex*, has been already mentioned. His other publications are, 1. An edition of Drummond's *Polemo Middinia*, and James V. of Scotland's *Cantilena Rustica*, with notes. 2. The *Chronicon Saxonicum*, with a Latin translation, and notes. 3. *Reliquiæ Spelmannianæ*, the posthumous works of Sir Henry Spelman, relating to the laws and antiquities of England. 4. An edition of *Quintilian de Arte Oratoria*, with notes. 5. An English translation of Camden's *Britannia*, with additions, two volumes folio: and, 6. A number of small pieces, that have been collected together and printed in three volumes folio.—His intense application to study impaired his health; notwithstanding which, he attained the age of 79. He expired in September 1748, after an episcopate of near 33 years.—With regard to Bishop Gibson's private life and character, he was in every respect a perfect economist. His abilities were so well adapted to discharge the duties of his sacred function, that during the incapacity of Archbishop Wake, the transaction of ecclesiastical affairs was committed to the bishop of London. He was a true friend to the established church and government, and as great an enemy to persecution. He was usually consulted by the most learned and exalted personages in church and state, and the greatest deference was paid to his judgment. He possessed the social virtues in an eminent degree; his beneficence was very extensive; and he had such generosity,

rosity, that he freely gave two thousand five hundred pounds, left him by Dr Crow, who was once his chaplain, to Crow's own relations, who were very poor.

GIDEON, the son of Joash, of the tribe of Manasseh. He dwelt in the city of Ophrah; and had a very extraordinary call to deliver the Israelites from the oppression of the Midianites, to which they had become subject after the death of Barak and Deborah. Having effected their deliverance by supernatural aid, he was chosen judge of Israel in the year of the world 2759, and died in 2768. (See Judges, chap. vi. vii. and viii.).

GIFT, *Donum*, in *Law*, is a conveyance which passeth either lands or goods; and is of a larger extent than a grant, being applied to things moveable and immoveable; yet as to things immoveable, when taken strictly, it is applicable only to lands and tenements given in tail; but *gift* and *grant* are too often confounded.

New Year's GIFTS, presents made on new year's day, as a token of the giver's good will, as well as by way of presage of a happy year.

This practice is very ancient, the origin of it among the Romans being referred to Tatius king of the Sabines, who reigned at Rome conjointly with Romulus, and who having considered as a good omen a present of some sprigs of vervain gathered in a wood consecrated to Strenia the goddess of strength, which he received on the first day of the new year, authorized this custom afterwards, and gave to these presents the name of Strenæ. However this may be, the Romans on that day celebrated a festival in honour of Janus, and paid their respects at the same time to Juno; but they did not pass it in idleness, lest they should become indolent during the rest of the year. They sent presents to one another of figs, dates, honey, &c. to show their friends that they wished them a happy and agreeable life. Clients, that is to say, those who were under the protection of the great, carried presents of this kind to their patrons, adding to them a small piece of silver. Under Augustus, the senate, the knights, and the people, presented such gifts to him, and in his absence deposited them in the Capitol. Of the succeeding princes some adopted this custom, and others abolished it, but it always continued among the people. The early Christians condemned it, because it appeared to be a relick of Paganism, and a species of superstition; but when it began to have no other object than that of being a mark of veneration and esteem, the church ceased to disapprove of it.

GIGG, GIGA, or JIG, in *Music* and *Dancing*, a gay, brisk, sprightly composition, and yet in full measure, as well as the allemand, which is more serious. Menage takes the word to arise from the Italian *gieg*, a musical instrument mentioned by Dante. Others suppose it to be derived from the Teutonic *giga*, or *ghiighe*, "a fiddle." This is a favourite air in most nations of Europe: its characteristic is duple time, marked $\frac{6}{8}$, or $\frac{12}{8}$: it consists of two strains, without any determinate number of bars.

GIGGLEWICK, a town in the west riding of Yorkshire, half a mile from Settle, stands on the river Ribble; where, at the foot of a mountain, is a spring, the most noted in England for ebbing and flowing sometimes thrice in an hour, and the water subsides three quarters of a yard at the reflux, though the sea is 30 miles off. At this town is an eminent free grammar school; and in the neighbourhood are dug up flags, slate, and stone.

GIHON, in *Ancient Geography*, one of the rivers of Paradise; according to Wells, the eastern branch of the Euphrates, into which it divides after its conjunction with the Tigris.

GILAN, or GHILAN, a considerable province of Persia, on the side of the Caspian sea, to the south-west. It is supposed to be the Hyrcania of the ancients. It is very agreeably situated, having the sea on one side and high mountains on the other; and there is no entering in but through narrow passes, which may easily be defended. The sides of the mountains are covered with many sorts of fruit trees, and in the highest parts of them there are deer, bears, wolves, leopards, and tygers; which last the Persians have a method of taming, and hunt with them as we do with dogs. Gilan is one of the most fruitful provinces of Persia, and produces abundance of silk, oil, wine, rice, and tobacco, besides excellent fruits. The inhabitants are brave, and of a better complexion than the other Indians, and the women are accounted extremely handsome. Resht is the capital town.

GILBERT, or GILBERD, *William*, a physician, was born at Colchester in the year 1540, the eldest son of the recorder of that borough. Having spent some time in both universities, he went abroad; and at his return settled in London, where he practised with considerable reputation. He became a member of the College of Physicians, and physician in ordinary to Queen Elizabeth, who, we are told, gave him a pension to encourage him in his studies. From his epitaph it appears that he was also physician to King James I. He died in the year 1603, aged 63; and was buried in Trinity church in Colchester, where a handsome monument was erected to his memory. His books, globes, instruments, and fossils, he bequeathed to the College of Physicians, and his picture to the school gallery at Oxford. He wrote, 1. *De Magnete, magneticisque corporibus, et de magno magnete tellure. physiologia nova;* London 1600, folio. 2. *De mundo nostro sublunari philosophia nova:* Amsterdam 1651, 4to. He was also the inventor of two mathematical instruments for finding the latitude at sea without the help of sun, moon, or stars. A description of these instruments was afterwards published by Thomas Blondeville in his *Theoriques of the Planets.*

GILBERT, *Sir Humphrey*, a brave officer and skilful navigator, was born about the year 1539, in Devonshire, of an ancient and honourable family. Though a second son, he inherited a considerable fortune from his father. He was educated at Eton, and afterwards at Oxford; where probably he did not continue long. It seems he was intended to finish his studies in the Temple; but being introduced at court by his aunt Mrs Catharine Ashley, then in the queen's service, he was diverted from the study of law, and commenced soldier. Having distinguished himself in several military expeditions, particularly that to Newhaven in 1563, he was sent over to Ireland to assist in suppressing a rebellion; where, for his signal services, he was made commander in chief and governor of Munster, and knighted by the lord deputy, Sir Henry Sidney, on the first day of the year 1570. He returned soon after to England, where he married a rich heiress, Nevertheless, in 1572, he sailed with a squadron of nine ships to reinforce Colonel Morgan, who at that time meditated the recovery of Flushing. Probably on his return to England he resumed his cosmographical studies, to which he was naturally inclined: for, in the year 1576, he published his book on the north-west passage to the East Indies; and as Martin Frobisher sailed in the same year, probably it was in consequence of this treatise. In 1578, he obtained from the queen a very ample patent, empowering him to discover and possess in North America any lands then unsettled. He sailed to Newfoundland, but soon returned to England without success; nevertheless, in 1583, he embarked a second time with five ships, the largest of which put back an account of a contagious distemper on board. Our general landed on Newfoundland on the third of August, and on the fifth took possession of the harbour of St John's. By virtue of his patent he granted leases to several people; but though none of them remained there at that time, they settled afterwards in consequence of these leases; so that Sir Humphrey deserves to be remembered as the real founder of the vast American empire. On the 20th of August he put to sea again, on board a small sloop; which on the 29th foundered in a hard gale of wind. Thus perished Sir Humphrey Gilbert; a man of quick parts, a brave soldier, a good mathematician, a skilful navigator, and of a very enterprising genius. We learn also, that he was remarkable for his eloquence, being much admired for his patriotic speeches both in the English and Irish parliaments. He wrote "A discourse to prove a passage by the north-west to Cathaia and the East Indies, printed London 1576." This treatise, which is a masterly performance, is preserved in Hakluyt's Collection of Voyages, vol. iii. p. 11. The style is superior to most, if not to all, the writers of that age; and shows the author to have been a man of considerable reading. He mentions, at the close of this work, another treatise on navigation, which he intended to publish: it is probably lost.

GILBERTINES, an order of religious, thus called from St Gilbert of Sempringham, in the county of Lincoln, who founded the same about the year 1148: the monks of which observed the rule of St Augustine; and were accounted canons; and the nuns that of St Benedict.

The founder of this order erected a double monastery, or rather two different ones, contiguous to each other, the one for men, the other for women, but parted by a very high wall.

St Gilbert himself founded 13 monasteries of this order, viz. four for men alone, and nine for men and women together, which had in them 700 brethren and 1500 sisters. At the dissolution there were about 25 houses of this order in England and Wales.

GILBOA, in *Ancient Geography*, mountains of Samaria, stretching out from west to east, on the confines of the half tribe of Manasseh, and of the tribe of Issachar, and to the south part of the valley of Jezreel; beginning westward at the city of Jezreel, situated at the foot of these mountains, reaching almost quite to the Jordan, lying at the distance of six miles from Scythopolis. Famous for the death of Saul and his son Jonathan, and the defeat of the Israelites by the Philistines.

GILCHRIST, Dr Ebenezer, an eminent Scots physician, was born at Dumfries in 1707. He began the study of medicine at Edinburgh, which he afterwards prosecuted at London and Paris. He obtained the degree of doctor of medicine from the university of Rheims; and in the year 1732 he returned to the place of his nativity, where he afterwards constantly resided, and continued the practice of medicine till his death. It may with justice be said, that few physicians of the present century have exercised their profession in a manner more respectable or successful than Dr Gilchrist; and few have contributed more to the improvement of the healing art. Having engaged in business at an early period of life, his attention was wholly devoted to observation. Endowed by nature with a judgment acute and solid, and a genus active and inventive, he soon distinguished himself by departing, in various important particulars, from established but unsuccessful modes of practice. Several of the improvements which he introduced have procured him great and deserved reputation both at home and abroad. His practice, in ordinary cases, was allowed to be judicious, and placed him high in the confidence and esteem of the inhabitants of that part of the country where he lived. But his usefulness was not confined to his own neighbourhood. On many occasions he was consulted by letter from the most distant parts of the country. In different collections are to be found several of his performances, which prove that he had something new and useful to offer upon every subject to which he applied himself. But those writings which do him the greatest honour are two long dissertations on Nervous Fevers, in the Medical Essays and Observations published by a Society in Edinburgh; and a treatise on the use of Sea Voyages in Medicine, which first made its appearance in the year 1757, and was afterwards reprinted in 1771. By means of the former, the attention of physicians was first turned to a species of fever which is now found to prevail universally in this country; and the liberal use of wine, which he was the first among the moderns to recommend, has since been adopted in these fevers by the most judicious physicians of the present age, and has probably contributed not a little to the success of their practice. His treatise on Sea Voyages points out their utility in various distempers, and particularly in consumptions; but experience by no means confirms the observation, that there is now a prospect of our being able to employ a remedy in this untractable disease much more efficacious than any hitherto in use. Dr Gilchrist died in 1774.

GILD, or Guild. See Guild.

GILDAS, surnamed *the Wise*, was born in Wales in the year 511. Where he was educated is uncertain; but it appears from his own writings that he was a monk. Some writers say that he went over to Ireland; others, that he visited France and Italy. They agree however in asserting, that after his return to England he became a celebrated and most assiduous preacher of the gospel. Du Pin says he founded a monastery at Venetia in Britain. Gildas is the only British author of the sixth century whose works are printed;

Gildas, Gilding.

printed; they are therefore valuable on account of their antiquity, and as containing the only information we have concerning the times of which he wrote. His History of Britain is, however, a flimsy performance, and his style obscure and inelegant.

GILDING, the art of spreading or covering a thing over with gold, either in leaf or liquid. The art of gilding was not unknown among the ancients, though it never arrived among them at the perfection to which the moderns have carried it. Pliny assures us, that the first gilding seen at Rome was after the destruction of Carthage, under the censorship of Lucius Mummius, when they began to gild the ceilings of their temples and palaces; the Capitol being the first place on which this enrichment was bestowed. But he adds, that luxury advanced on them so hastily, that in a little time you might see all, even private and poor persons, gild the very walls, vaults, &c. of their houses.

1 Gilding when first introduced at Rome.

We need not doubt but they had the same method with us, of beating gold, and reducing it into leaves; though it should seem they did not carry it to the same height, if it be true which Pliny relates, that they only made 750 leaves of four fingers square out of a whole ounce. Indeed he adds, that they could make more; that the thickest were called *bracteæ Prænestinæ*, by reason of a statue of the goddess Fortune at Præneste gilt with such leaves; and that the thinner sort was called *bracteæ questoriæ*.

The modern gilders do also make use of gold leaves of divers thicknesses; but there are some so fine, that a thousand do not weigh above four or five drachms. The thickest are used for gilding on iron and other metals; and the thinnest on wood. But we have another advantage over the ancients in the manner of using or applying the gold: the secret of painting in oil, discovered of late ages, furnishes us with means of gilding works that shall endure all the injuries of time and weather, which to the ancients was impracticable.—They had no way to lay the gold on bodies that would not endure the fire but with whites of eggs or size, neither of which will endure the water; so that they could only gild such places as were sheltered from the moisture of the weather.

2 Ancient gilding inferior to the modern.

The Greek called the composition on which they applied their gilding on wood *leucophæum* or *leucophorum*; which is described as a sort of glutinous compound earth, serving in all probability to make the gold stick and bear polishing. But the particulars of this earth, its colour, ingredients, &c. the antiquaries and naturalists are not agreed upon.

The lustre and beauty of gold have occasioned several inquiries and discoveries concerning the different methods of applying it to different substances. Hence the art of gilding is very extensive, and contains many particular operations and various management.

3 False gilding with laquer or Dutch leaf.

A colour of gold is given by painting and by varnishes, without employing gold; but this is a false kind of gilding. Thus a very fine golden colour is given to brass and to silver, by applying upon these metals a gold-coloured varnish, which, being transparent, shows all the brilliancy of the metals beneath. Many ornaments of brass were varnished in this manner, which is called *gold laquering*, to distinguish them from those which are really gilt. Silver leaves thus varnished are put upon leather, which is then called *gilt leather*. See Laquer.

Gilding.

Amongst the false gilding may also be reckoned those which are made with thin leaves of copper or brass, called *Dutch leaf*. In this manner are made all the kinds of what is called *gilt paper*.

In the true gilding, gold is applied to the surface of bodies. The gold intended for this purpose ought in general to be beat into thin leaves, or otherwise divided into very fine parts.

4 Gilding with size.

As metals cannot adhere well merely by contact to any but to other metallic substances, when gold is to be applied to the surface of some unmetallic body, that surface must be previously covered with some gluey and tenacious substance by which the gold shall be made to adhere. These substances are in general called *sizes*. Some of these are made of vegetable and animal glues, and others of oily, gluey, and drying matters. Upon them the leaves of gold are applied, and pressed down with a little cotton or a hare's foot; and when the whole is dry, the work is to be finished and polished with a hard instrument, called a *dog's tooth*, to give lustre.

5 With oil.

When the work is required to be capable of resisting rain or moisture, it ought to be previously covered with a composition of drying oil and yellow ochre ground together; otherwise a water size may be used, which is prepared by boiling cuttings of parchment or white leather in water, and by mixing with this some chalk or whiting: several layers of this size must be laid upon the wood, and over these a layer of the same size mixed with yellow ochre. Lastly, Another mixture, called *gold size*, is to be applied above these; upon which the gold leaves are to be fixed. This gold size, the use of which is to make the gold leaf capable of being burnished, is composed of tobacco-pipe clay, ground with some ruddle or black-lead, and tempered with a little tallow or oil of olives. The edges of glasses may be gilt by applying first a very thin coat of varnish, upon which the gold leaf is to be fixed; and when the varnish is hardened, may be burnished. This varnish is prepared by boiling powdered amber with linseed oil in a brass vessel to which a valve is fitted, and by diluting the above solution with four or five times its quantity of oil of turpentine; and that it may dry sooner, it may be ground with some white lead.

6 Of gilding metals.

The method of applying gold upon metals is entirely different. The surface of the metal to be gilt is first to be cleaned; and then leaves are to be applied to it, which, by means of rubbing with a polished bloodstone, and a certain degree of heat, are made to adhere perfectly well. In this manner silver leaf is fixed and burnished upon brass in the making of what is called *French plate*, and sometimes also gold leaf is burnished upon copper and upon iron.

Gold is applied to metals in several other ways. One of these is by previously forming the gold into a paste or amalgam with mercury. In order to obtain a small amalgam of gold and mercury, the gold is first to be reduced into thin plates or grains, which are heated red hot, and thrown into mercury previously heated, till it begins to smoke. Upon stirring the mercury with an iron rod, the gold totally disappears. The proportion of mercury to gold is generally as six or eight to one.

With

Gilding.

With this amalgam the surface of the metal to be gilded is to be covered; then a sufficient heat is to be applied to evaporate the mercury: and the gold is lastly to be burnished with a blood-stone.

This method of gilding by amalgamation is chiefly used for gilding copper, or an alloy of copper, with a small portion of zinc, which more readily receives the amalgam; and is also preferable for its colour, which more resembles that of gold than the colour of copper. When the metal to be gilt is wrought or chased, it ought to be previously covered with quicksilver before the amalgam is applied, that this may be easier spread: but when the surface of the metal is plain, the amalgam may be applied directly to it. The quicksilver or amalgam is made to adhere to the metal by means of a little aquafortis, which is rubbed on the metallic surface at the same time, by which this surface is cleansed from any rust or tarnish which might prevent the union or adhesion of the metals. But the use of the nitrous acid in this operation is not, as is generally supposed, confined merely to cleanse the surface of the metal to be gilt from any rust or tarnish it may have acquired; but it also greatly facilitates the application of the amalgam to the surface of that metal, probably in the following manner: It first dissolves part of the mercury of the amalgam; and when this solution is applied to the copper, this latter metal having a stronger affinity for nitrous acid than the mercury has, precipitates the mercury upon its surface, in the same manner as a polished piece of iron precipitates copper upon its surface from a solution of blue vitriol. When the metal to be gilt is thus covered over with a thin precipitated coat of mercury, it readily receives the amalgam. In this solution and precipitation of mercury, the principal use of the nitrous acid in the process of gilding appears to consist. The amalgam being equally spread over the surface of the metal to be gilt by means of a brush, the mercury is then to be evaporated by a heat just sufficient for that purpose; for if it be too great, part of the gold may also be expelled, and part of it will run together, and leave some of the surface of the metal bare: while the mercury is evaporating, the piece is to be from time to time taken from the fire, that it may be examined, that the amalgam may be spread more equally by means of a brush, that any defective parts of it may be again covered, and that the heat may not be too suddenly applied to it: when the mercury is evaporated, which is known by the surface being entirely become of a dull yellow colour, the metal must then undergo other operations, by which the fine gold colour is given to it. First, The gilded piece of metal is rubbed with a scratch brush (which is a brush composed of brass wire) till its surface is made smooth; then it is covered over with a composition called *gilding wax*, and is again exposed to the fire till the wax be burnt off. This wax is composed of bees wax, sometimes mixed with some of the following substances; red ochre, verdigrise, copper scales, alum, vitriol, borax: but according to Dr Lewis, the saline substances alone are sufficient, without any wax. By this operation the colour of the gilding is heightened; and this effect seems to be produced by a perfect dissipation of some mercury remaining after the former operation. This dissipation is well effected by this equable application of heat. The gilt surface is then covered over with a saline composition, consisting of nitre, alum, or other vitriolic salt, ground together, and mixed up into a paste with water or urine. The piece of metal thus covered is exposed to a certain degree of heat, and then quenched in water. By this method its colour is further improved, and brought nearer to that of gold. This effect seems to be produced by the acid of nitre (which is disengaged by the vitriolic acid of the alum, or other vitriolic salt, during the exposure to heat) acting upon any particles of copper which may happen to lie on the gilded surface. Lastly, Some artists think that they give an additional lustre to their gilt work by dipping it in a liquor prepared by boiling some yellow materials, as sulphur, orpiment, or turmeric. The only advantage of this operation is, that a part of the yellow matter, as the sulphur or turmeric, remains in some of the hollows of the carved work, in which the gilding is apt to be more imperfect, and to which it gives a rich and solid appearance.

7 [...]e of the [...]rous acid [...] gilding.

Iron cannot be gilt by amalgamation, unless, as it is said, it be previously coated with copper by dipping in a solution of blue vitriol. Iron may also receive a golden coat from a saturated solution of gold in aqua-regia, mixed with spirit of wine, the iron having a greater affinity with the acid, from which it therefore precipitates the gold. Whether any of these two methods be applicable to use, is uncertain: but the method commonly employed of fixing gold upon iron is that above mentioned, of burnishing gold leaf upon this metal when heated so as to become blue; and the operation will be more perfect if the surface has been previously scratched or graved.

Another method is mentioned by authors of gilding upon metals, and also upon earthen ware, and upon glass; which is, to fuse gold with regulus of antimony, to pulverize the mass which is sufficiently brittle to admit that operation, to spread this powder upon the piece to be gilt, and expose it to such a fire that the regulus may be evaporated, while the gold remains fixed. The inconveniences of this method, according to Dr Lewis, are, that the powder does not adhere to the piece, and cannot be equally spread; that part of the gold is dissipated along with the regulus; that glass is fusible with the heat necessary for the evaporation of regulus of antimony; and that copper is liable to be corroded by the regulus, and to have its surface rendered uneven.

8 Improvement by Dr Lewis. *Phil. Com. of Arts.*

On this subject of gilding by amalgamation Dr Lewis has the following remarks. "There are two principal inconveniences in this business: One, that the workmen are exposed to the fumes of the mercury, and generally, sooner or later, have their health greatly impaired by them: the other, the loss of the mercury; for though part of it is said to be detained in cavities made in the chimney for that purpose, yet the greatest part of it is lost. From some trials I have made, it appeared that both these inconveniences, particularly the first and most considerable one, might in good measure be avoided, by means of a furnace of a due construction. If the communication of a furnace with its chimney, instead of being over the fire, is made under the grate, the ash-pit door, or other apertures beneath the grate, closed, and the mouth of the furnace left open; the current of air, which otherwise would have entered beneath, Gilding. neath, enters now at the top, and passing down through the grate to the chimney, carries with it completely both the vapour of the fuel and the fumes of such matters as are placed upon it: the back part of the furnace should be raised a little higher above the fire than the fore part, and an iron plate laid over it, that the air may enter only at the front, where the workman stands, who will be thus effectually secured from the fumes and from being incommoded with the heat, and at the same time have full liberty of introducing, inspecting, and removing the work. If such a furnace is made of strong forged (not milled) iron plate, it will be sufficiently durable: the upper end of the chimney may reach above a foot and a half higher than the level of the fire: over this is to be placed a larger tube, leaving an interval of an inch or more all round between it and the chimney, and reaching to the height of 10 or 12 feet, the higher the better. The external air, passing up between the chimney and the outer pipe, prevents the latter from being much heated, so that the mercurial fumes will condense against its sides into running quicksilver, which, falling down to the bottom, is there catched in a hollow rim, formed by turning inwards a portion of the lower part, and conveyed, by a pipe at one side, into a proper receiver.

9 M. du Fay's method of raising gold figures.

"Mr Hellot communicates, in the Memoirs of the French Academy for the year 1745, a method of making raised figures of gold on works of gold or silver, found among the papers of M. du Fay, and of which M. du Fay himself had seen several trials. Fine gold in powder, such as results from the parting of gold and silver by aquafortis, is directed to be laid in a heap on a levigating stone, a cavity made in the middle of the heap, and half its weight of pure mercury put into the cavity; some of the fetid spirit obtained from garlic root by distillation in a retort, is then to be added, and the whole immediately mingled and ground with a muller till the mixture is reduced into an uniform gray powder. The powder is to be ground with lemon juice to the consistence of paint, and applied on the piece previonsly well cleaned and rubbed over with the same acid juice; the figures drawn with it may be raised to any degree by repeating the application. The piece is exposed to a gentle fire till the mercury is evaporated so as to leave the gold yellow, which is then to be pressed down, and rubbed with the finger and a little sand, which makes it appear solid and brilliant; after this it may be cut and embellished. The author observes, that being of a spongy texture, it is more advisable to cut it with a chissel than to raise it with a graver; that it has an imperfection of being always pale; and that it would be a desirable thing to find means of giving it colour, as by this method ornaments might be made of exquisite beauty, and with great facility. As the paleness appears to proceed from a part of the mercury retained by the gold, I apprehend it might be remedied by the prudent application of a little warm aquafortis, which dissolving the mercury from the exterior part, would give at least a superficial high colour: if the piece is silver, it must be defended from the aquafortis by covering it with wax. Instruments and ornaments of gold, stained by mercury where the gold is connected with substances incapable of bearing fire, may be restored to their colour by the same means.

"The foregoing process is given entirely on the authority of the French writer. I have had no experience of it myself, but have seen very elegant figures of gold raised upon silver, on the same principle, by a different procedure. Some cinnabar was ground, not with the distilled spirit, but with the expressed juice of garlic, a fluid remarkably tenacious. This mixture was spread all over the polished silver; and when the first layer is dry, a second, and after this a third, was applied. Over these were spread as many layers of another mixture, composed chiefly of asphaltum and linseed oil boiled down to a due consistence. The whole being dried with a gentle heat on a kind of wire grate, the figures were traced and cut down to the silver so as to make its surface rough: the incisions were filled with an amalgam of gold, raised to different heights in different parts according to the nature of the design; after which a gentle fire, at the same time that it evaporated the mercury, destroyed the tenacity of the gummy juice, so that the coating, which served to confine the amalgam, and as a guide in the application of it, was now easily got off. The gold was then pressed down and embellished as in the former method; and had this advantage, that the surface of the silver under it having been made rough, it adhered more firmly, so as not to be in danger of coming off, as M. du Fay says the gold applied in his way sometimes did. The artist, however, found the process so troublesome, that though he purchased the receipt for a considerable sum, he has laid the practice aside."

10 Another method.

Finally, Some metals, particularly silver, may be gilt in the following manner:

11 Easy method of gilding silver.

Let gold be dissolved in aqua-regia. In this solution pieces of linen are to be dipt, and burnt to black ashes. These ashes being rubbed on the surface of the silver by means of a wet linen rag, apply the particles of gold which they contain, and which by this method adhere very well. The remaining part of the ashes is to be washed off; and the surface of the silver, which in this state does not seem to be gilt, is to be burnished with a blood-stone, till it acquire a fine colour of gold. This method of gilding is very easy, and consumes a very small quantity of gold. Most gilt ornaments upon fans, snuff boxes, and other toys of much show and little value, are nothing but silver gilt in this manner.

12 Methods of gilding glass.

Gold may also be applied to glass, porcelain, and other vitrified matters. As the surface of these matters is very smooth, and consequently is capable of a very perfect contact with gold leaves, these leaves adhere to them with some force, although they are not of metallic nature. This gilding is so much more perfect, as the gold is more exactly applied to the surface of the glass. The pieces are then to be exposed to a certain degree of heat, and burnished slightly to give them lustre.

A more substantial gilding is fixed upon glass, enamel, and porcelain, by applying to these subtances powder of gold mixed with a solution of gum arabic, or with some essential oil, and a small quantity of borax; after which a sufficient heat is to be applied to soften the glass and the gold, which is then to be burnished. With this mixture any figures may be drawn. The powders for this purpose may be made, 1. By grinding gold leaf with honey, which is afterwards to

Gilding of Gill. to be washed away with water. 2. By distilling to dryness a solution of gold in aqua-regia. 3. By evaporating the mercury from an amalgam of gold, taking care to stir well the mass near the end of the process. 4. By precipitating gold from its solution in aqua-regia, by applying to it a solution of green vitriol in water, or some copper, and perhaps some other metallic substances.

GILEAD, the son of Machir, and grandson of Manasseh, had his inheritance allotted him in the mountains of Gilead, from whence he took his name. The mountains of Gilead were part of that ridge which runs from Mount Lebanon southward, on the east of the Holy Land; gave their name to the whole country which lies on the east of the sea of Galilee, and included the mountainous region called in the New Testament *Trachonitis*. Jeremiah (xxii. 6.) seems to say, that Gilead begins from Mount Libanus. 'Thou art Gilead unto me, and the head of Lebanon.' Jacob, at his return from Mesopotamia, came in six days to the mountains of Gilead (Gen. xxxi. 21. &c.) where this patriarch, with Laban his father-in-law, raised a heap of stones, in memory of their agreement and covenant, and called it *Galeed*, i. e. "an heap of witnesses," and which Laban called *Jegar-sahadutha*. These mountains were covered with a sort of trees abounding with gum, called the *Balm of Gilead*, which the Scripture commends much (Jer. viii. 21. xlvi. 11. li. 8.). The merchants who bought Joseph came from Gilead, and were carrying balm into Egypt, (Gen. xxxvii. 25.).

The Gileadites being invaded by the Ammonites, &c. chose Jephthah for their general, who vanquished all their enemies.

Balm of GILEAD. See AMYRIS, BOTANY *Index*.

GILGAL, in *Ancient Geography*, a place between Jericho and Jordan, noted for the first encampment of the Israelites on this side Jordan, about a mile from Jericho. It sometimes also denotes Galilee, (Joshua xii. 23.).

GILL, JOHN, D. D. a Protestant dissenting minister of the Baptist denomination, and the son of Edward and Elizabeth Gill, was born at Kettering in Northamptonshire, November 23. 1697. At a very early period of life, his father, who was a deacon of the Baptist church at Kettering, discovered in him an uncommon capacity for learning; and his ability for literary pursuits afterwards appeared by the rapid progress in whatever became the object of his study. He was sent to a grammar school in the neighbourhood; where he soon surpassed those boys who were much his seniors in age and as pupils. At this school he continued till he arrived at his 11th year; where he read most of the Latin classics, and made considerable proficiency in the Greek language.

Mr Gill's celebrity as a scholar, and his strong attachment to books, were soon observed by the neighbouring clergy, who frequently met and conversed with him at a bookseller's shop, to which he resorted for the purpose of reading; and indeed such was his application to books, that it became a proverbial saying among the common people, "Such a thing is as certain, as that John Gill is in the bookseller's shop."

He left the grammar school, however, early in life. This was occasioned by the imperious conduct of his master, who insisted that the children of dissenting parents should, with other scholars that belonged to the establishment, attend him to church on week days during the performance of divine service. The dissenters considered this requisition as a stretch of power to which his engagements with them gave no claim; and as it was virtually making conformity a test by which his pupils were to expect the benefits of tuition, they resented his conduct; and the children of those parents that were in affluent circumstances were removed to seminaries where the same advantages might be obtained without being subject to the impositions of clerical bigotry. But as the parents of Mr Gill had it not in their power to confer on him the same privilege, the same steps could not be taken to facilitate his advancement in learning. To pave the way, however, for the completion of his studies, efforts were made by several ministers, of different denominations, to get him upon one or other of the funds in London. For this purpose specimens of his progress in the different branches of literature were transmitted to the metropolis: in answer to which it was objected, "that he was too young, and that should he continue, as it might be expected he would, to make such rapid advances in his studies, he would go through the common circle before he would be capable of taking care of himself, or of being employed in any public service." But these formidable objections were of no weight with our young scholar: his love of learning was unconquerable. Insuperable difficulties, it is true, obstructed the way in which literary eminence is usually acquired; but these difficulties could neither repress his ardent desire of knowledge, nor damp the zeal and application that had marked his former studies. For though his time was daily devoted to the business of his father; yet he had so far improved the hours of leisure, as to be able, before he arrived at his 19th year, to read all the Greek and Latin authors that fell in his way. He studied logic, rhetoric, moral and natural philosophy; and learnt the Hebrew language so as to read it with ease, without any other assistance than Buxtorf's grammar and lexicon.

Neither the pursuit of learning, however, nor the other necessary avocations incumbent on Mr Gill, could eradicate those religious impressions received in early life. On November 1. 1716, he made a public profession of his faith before the Baptist church at Kettering, and was baptized the same day by Mr Thomas Wallis. Of this church Mr Gill had not been long a member before he was called to the work of the ministry: soon after which, he removed to Higham-Ferrers, with a view to pursue his studies under the direction of Mr Davis; but his stay at this place was soon interrupted by an invitation from London in 1719, to preach to the Baptist church in Horslydown, over which he was the same year, being the 22d of his age, ordained pastor; which office he sustained upwards of 51 years.

Mr Gill had not been long in London, before rabbinical learning, of which he had before considerable knowledge, became an object of pursuit. To facilitate his progress through the intricacies of this labyrinth, he contracted an acquaintance with one of the most learned Jewish rabbies. He read the Targums, the Talmuds, the Rabbot, their ancient commentaries, the book Zohar, and whatever else of this kind he was able to procure. Of the oriental languages he made himself

himself a complete master: in short, there was no branch of knowledge that could either enlarge or enrich Biblical learning, which, however difficult, was not attempted and attained: and it may be truly asserted, that in this line he had but few equals, and that the annals of literature do not exhibit a character by whom he was excelled.

In 1748, Mr Gill published a commentary on the New Testament, in three volumes folio. The immense reading and learning discoverable in this arduous work, attracted the attention of the Marischal College and University of Aberdeen; and procured for him, without either his solicitation or his knowledge, a diploma, creating him doctor in divinity. This intelligence was communicated to the doctor in the most handsome terms by the professors Osborn and Pollock; who declared, "that on account of his knowledge of the Scriptures, of the Oriental languages, and of Jewish antiquities, of his learned defence of the Scriptures against Deists and Infidels, and the reputation gained by his other works; the university had, without his privity, unanimously agreed to confer on him the degree of doctor in divinity."

Dr Gill's sentiments, as a divine, were throughout Calvinistic: "And perhaps no man (says the Rev. Mr Toplady, a minister in the church of England) since the days of Austin, has written so largely in defence of the system of grace; and certainly no man has treated that momentous subject in all its branches, more closely, judiciously, and successfully. What was said of Edward the Black Prince, that he never fought a battle which he did not win; what has been remarked of the great duke of Marlborough, that he never undertook a siege which he did not carry; may be justly accommodated to our great philosopher and divine; who, so far as the distinguishing doctrines of the gospel are concerned, never besieged an error which he did not force from its strong holds, nor ever encountered an adversary whom he did not baffle and subdue. His learning and labours, if exceedable, were exceeded only by the invariable sanctity of his life and conversation. From his childhood to his entrance on the ministry, and from his entrance on the ministry to the moment of his dissolution, not one of his most inveterate opposers was ever able to charge him with the least shadow of immorality. Himself, no less than his writings, demonstrated that the doctrine of grace does not lead to licentiousness. Those who had the honour and happiness of being admitted into the number of his friends, can go still farther in their testimony. They know that his moral demeanor was more than blameless: it was from first to last consistently exemplary. And indeed an undeviating consistency, both in his views of evangelical truths, and in his obedience as a servant of God, was one of those qualities by which his cast of character was eminently marked. He was in every respect a burning and a shining light: Burning with love to God, to truth, and to souls; shining as an example to believers, in word, in faith, in purity; a pattern of good works, and a model of all holy conversation and godliness; and while true religion and sound learning have a single friend remaining in the British empire, the works and name of Gill will be precious and revered."

He died at Camberwell, October 14. 1771, aged 73 years 10 months and 10 days. In 1718, the Doctor married Mrs Elizabeth Negus; by whom he had many children, two of whom only survived him. Mrs Gill died in 1764.

His works are, A Commentary on the Old and New Testament in 9 vols folio. A Body of Divinity in 3 vols quarto. The Cause of God and Truth, 4 vols 8vo. A Treatise concerning the Prophecies of the Old Testament respecting the Messiah. A Dissertation on the antiquity of the Hebrew Language, Letters, Vowel Points, and Accents. Sermons on the Canticles, folio; besides a great number of sermons and controversial pieces on different subjects.

GILL, a measure of capacity, containing a quarter of an English pint.

GILLS or BRANCHIÆ of fishes. See ANATOMY *Index*.

GILLINGHAM, a parish in Dorsetshire, on the river Stour, near the forest of its own name; where, anno 1016, King Edmund Ironside vanquished the Danes. It is one of the largest parishes in the county, being 41 miles in circuit, containing 64,000 acres. It lies on the borders of Wilts and Somerset, four miles north-west of Shaftsbury. It has a manufacture of linen, but the chief produce is grazing and the dairies. Near it are the traces of an ancient residence of Norman or Saxon kings, 320 feet long and 240 broad, surrounded by a rampart of earth. Henry I. resided here, and King John repaired it at the expence of the county. Edward I. spent his Christmas here in 1270; but the whole of the materials are removed, and the foundation of the house only can be traced, which was in the form of the letter L, in length 180 feet by 80 broad, and the foot of the letter 48 by 40; the area of the house containing 168,000 square feet. It stood half a mile from the church, on the road to Shaston, encompassed by a moat, now dry, in some places nine feet deep and 20 broad. The rampart appears to have been 30 feet thick. Here is a free school, a large old building, and a workhouse, as well as two stone bridges. In 1694, it received damage of near 4000l. by a fire. Near it is Gillingham forest, four miles long and one mile broad. The church is a large ancient fabric.

GILLINGHAM, a parish of Kent, three miles below Chatham, and on the same side of the Medway. Part of Chatham dock is in this parish; and here is a castle well furnished with guns that commands the river, there being no less than 170 embrasures for cannon; which would stop the progress of any enemy that should happen to make way by Sheerness fort, before they could reach Chatham. Here are also copperas works. At this place 600 Norman gentlemen, who came over in the retinue of the two princes Alfred and Edward, were all barbarously murdered by Earl Godwin. It was in remote times the property of the archbishop of Canterbury, who had here an elegant palace, the old hall of which is now converted into a barn; it is built principally of flint, but the windows are filled up with brick. Near it are the remains of the chapel, &c. and a great part of the whole of its original outer walls may be traced.

GILOLO, a large island of the Pacific ocean, lying between 1° S. Lat. and 2° N. Lat. and between 125° and 128° E. Long. It belongs to the Dutch; but

but does not produce any of the fine spices, though it lies in the neighbourhood of the spice islands. The natives are fierce and cruel savages.

GILPIN, Bernard, rector of Houghton, distinguished by his extraordinary piety and hospitality, was descended from an ancient and honourable family in Westmoreland, and born in 1517. As he was bred in the Catholic religion, so he for some time defended it against the reformers, and at Oxford held a disputation with Hooper, afterward bishop of Worcester and a martyr for the Protestant faith; but was staggered in another disputation with Peter Martyr, and began seriously to examine the contested points by the best authorities. Thus, being presented to the vicarage of Norton in the diocese of Durham, he soon resigned it, and went abroad to consult eminent professors on both sides; and after three years absence returned a little before the death of Queen Mary, satisfied in the general doctrines of the reformation. He was kindly received by his uncle Dr Tonstall, bishop of Durham; who soon after gave him the archdeaconry of Durham, to which the rectory of Effington was annexed. When repairing to his parish, though the persecution was then at its height, he boldly preached against the vices, errors, and corruptions of the times, especially in the clergy, on which a charge consisting of 13 articles was drawn up against him, and presented in form to the bishop. But Dr Tonstall found a method of dismissing the cause in such a manner as to protect his nephew, without endangering himself, and soon after presented him to the rich living of Houghton le Spring. He was a second time accused to the bishop, and again protected; when his enemies, enraged at this second defeat, laid their complaint before Dr Bonner, bishop of London; who immediately gave orders to apprehend him. Upon which Mr Gilpin bravely prepared for martyrdom; and ordering his house steward to provide him a long garment that he might make a decent appearance at the stake, set out for London. Luckily, however, he broke his leg on the journey; which protracted his arrival until the news of the queen's death freed him from all further apprehensions. Being immediately set at liberty, he returned to Houghton, where he was received by his parishioners with the sincerest joy.

Upon the deprivation of the Popish bishops, he was offered the see of Carlisle, which he declined; and confining his attention to his rectory, discharged all the duties of his function in the most exemplary manner. To the greatest humanity and courtesy, he added an unwearied application to the instruction of those under his care. He was not satisfied with the advice he gave in public, but used to instruct in private; and brought his parishioners to come to him with their doubts and difficulties. He had a most engaging manner towards those whom he thought well disposed: nay, his very reproof was so conducted, that it seldom gave offence; the becoming gentleness with which it was urged made it always appear the effect of friendship. Thus, with unceasing assiduity, did he employ himself in admonishing the vicious, and engaging the well-intentioned; by which means, in a few years, he made a greater change in his neighbourhood than could well have been imagined. A remarkable instance, what reformation a single man may effect, when he hath it earnestly at heart!

But his hopes were not so much in the present generation, as in the succeeding. It was an easier task, he found, to prevent vice, than to correct it; to form the young to virtue, than to amend the bad habits of the old. He employed much of his time, therefore, in endeavouring to improve the minds of the younger part of his parish; suffering none to grow up in an ignorance of their duty; but pressing it as the wisest part to mix religion with their labour, and amidst the cares of this life to have a constant eye upon the next. He attended to every thing which might be of service to his parishioners. He was very assiduous in preventing all law suits among them. His hall is said to have been often thronged with people, who came to him about their differences. He was not indeed much acquainted with law; but he could decide equitably, and that satisfied: nor could his sovereign's commission have given him more weight than his own character gave him.

His hospitable manner of living was the admiration of the whole country. He spent in his family every fortnight 40 bushels of corn, 20 bushels of malt, and a whole ox; besides a proportionable quantity of other kinds of provision. Strangers and travellers found a cheerful reception. All were welcome that came; and even their beasts had so much care taken of them, that it was humorously said, "If a horse was turned loose in any part of the country, it would immediately make its way to the rector of Houghton's."

Every Sunday, from Michaelmas till Easter, was a sort of public day with him. During this season he expected to see all his parishioners and their families. For their reception, he had three tables well covered; the first was for gentlemen, the second for husbandmen and farmers, and the third for day labourers. This piece of hospitality he never omitted, even when losses, or a scarcity of provision, made its continuance rather difficult to him. He thought it his duty, and that was a deciding motive. Even when he was absent from home, no alteration was made in his family expences; the poor were fed as usual, and his neighbours entertained.

But notwithstanding all his painful industry, and the large scope it had in so extended a parish, Mr Gilpin thought the sphere of his benevolence yet too confined. It grieved him extremely to see everywhere, in the parishes around him, so great a degree of ignorance and superstition, occasioned by the shameful neglect of the pastoral care in the clergy of those parts. These bad consequences induced him to supply, as far as he could, what was wanting in others. For this purpose, every year he used regularly to visit the most neglected parishes in Northumberland, Yorkshire, Cheshire, Westmoreland, and Cumberland; and that his own parish in the mean time might not suffer, he was at the expence of a constant assistant. In each place he staid two or three days; and his method was, to call the people about him, and lay before them, in as plain a way as possible, the danger of leading wicked or even careless lives; explaining to them the nature of true religion; instructing them in the duties they owed to God, their neighbour, and themselves; and showing them how greatly a moral and religious conduct would contribute to their present as well as future happiness.

As Mr Gilpin had all the warmth of an enthusiast, though

Gilpin.

though under the direction of a very calm and sober judgment, he never wanted an audience, even in the wildest parts; where he roused many to a sense of religion, who had contracted the most inveterate habits of inattention to every thing of a serious nature. And wherever he came, he used to visit all the gaols and places of confinement; few in the kingdom having at that time any appointed minister. And by his labours, and affectionate manner of behaving, he is said to have reformed many very abandoned persons in those places. He would employ his interest likewise for such criminals whose cases he thought attended with any hard circumstances, and often procured pardons for them.

There is a tract of country upon the border of Northumberland, called *Reads-dale* and *Tine-dale*, of all barbarous places in the north at that time the most barbarous. Before the Union, this place was called the *debateable land*, as subject by turns to England and Scotland, and the common theatre where the two nations were continually acting their bloody scenes. It was inhabited by a kind of desperate banditti, rendered fierce and active by constant alarms: they lived by theft, used to plunder on both sides of the barrier; and what they plundered on one, they exposed to sale on the other; by that means escaping justice. And in this dreadful country, where no man would even travel that could help it, Mr Gilpin never failed to spend some part of every year.

He generally chose the Christmas holidays for his journey, because he found the people at that season most disengaged, and most easily assembled. He had set places for preaching, which were as regularly attended as the assize towns of a circuit. If he came where there was a church, he made use of it: if not, of barns, or any other large building; where great crowds of people were sure to attend him, some for his instructions, and others for his charity. This was a very difficult and laborious employment. The country was so poor, that what provision he could get, extreme hunger only could make palatable. The inclemency of the weather, and the badness of the roads through a mountainous country, and at that season covered with snow, exposed him likewise often to great hardships. Sometimes he was overtaken by the night, the country being in many places desolate for several miles together, and obliged to lodge out in the cold. At such times, we are told, he would make his servant ride about with his horses, whilst himself on foot used as much exercise at his age and the fatigues of the preceding day would permit. All this he cheerfully underwent; esteeming such services well compensated by the advantages which he hoped might accrue from them to his uninstructed fellow creatures.

The disinterested pains he took among these barbarous people, and the good offices he was always ready to do them, drew from them the warmest and sincerest expressions of gratitude. Indeed he was little less than adored among them, and might have brought the whole country almost to what he pleased. One instance that is related, shows how greatly he was revered. By the carelessness of his servants, his horses were one day stolen. The news was quickly propagated, and every one expressed the highest indignation at the fact. The thief was rejoicing over his prize, when, by the report of the country, he found whose horses he had taken. Terrified at what he had done, he instantly came trembling back, confessed the fact, returned the horses, and declared he believed the devil would have seized him directly, had he carried them off knowing them to have been Mr Gilpin's.

Gilpin.

We have already taken notice of Mr Gilpin's uncommonly generous and hospitable manner of living. The value of his rectory was about 400l. a year: an income, indeed, at that time very considerable, but yet in appearance very disproportionate to the generous things he did: indeed, he could not have done them, unless his frugality had been equal to his generosity. His friends, therefore, could not but wonder to find him, amidst his many great and continual expences, entertain the design of building and endowing a grammar school; a design, however, which his exact economy soon enabled him to accomplish, though the expence of it amounted to upwards of 500l. His school was no sooner opened, than it began to flourish; and there was so great a resort of young people to it, that in a little time the town was not able to accommodate them. He put himself, therefore, to the inconvenience of fitting up a part of his own house for that purpose, where he seldom had fewer than 20 or 30 children. Some of these were the sons of persons of distinction, whom he boarded at easy rates: but the greater part were poor children, whom he not only educated, but clothed and maintained: he was at the expence likewise of boarding in the town many other poor children. He used to bring several every year from the different parts where he preached, particularly Reads-dale and Tine-dale; which places he was at great pains in civilizing, and contributed not a little towards rooting out that barbarism which every year prevailed less among them.

As to his school, he not only placed able masters in it, whom he procured from Oxford, but himself likewise constantly inspected it. And, that encouragement might quicken the application of his boys, he always took particular notice of the most forward: he would call them *his own scholars*, and would send for them often into his study, and there instruct them himself. One method used by him to fill his school was a little singular. Whenever he met a poor boy upon the road, he would make trial of his capacity by a few questions, and if he found it such as pleased him, he would provide for his education. And besides those whom he sent from his own school to the universities, and there wholly maintained, he would likewise give to others, who were in circumstances to do something for themselves, what farther assistance they needed. By which means he induced many parents to allow their children a liberal education, who would otherwise not have done it. And Mr Gilpin did not think it enough to afford the means only of an academical education to these young people, but endeavoured to make it as beneficial to them as he could. He still considered himself as their proper guardian; and seemed to think himself bound to the public for their being made useful members of it, as far as it lay in his power to make them so. With this view he held a punctual correspondence with their tutors; and made the youths themselves frequently write to him, and give him an account of their studies. So solicitous indeed was he

about

about them, knowing the many temptations to which their age and situation exposed them, that once every other year he generally made a journey to the universities to inspect their behaviour. And this uncommon care was not unrewarded; for many of his scholars became ornaments to the church, and exemplary instances of piety.

To the account that hath been already given of Mr Gilpin's hospitality and benevolence, the following particulars may be added. Every Thursday throughout the year, a very large quantity of meat was dressed wholly for the poor; and every day they had what quantity of broth they wanted. Twenty-four of the poorest were his constant pensioners. Four times in the year a dinner was provided for them; when they received from his steward a certain quantity of corn, and a sum of money: and at Christmas they had always an ox divided among them.

Whenever he heard of any in distress, whether of his own parish or any other, he was sure to relieve them. In his walks abroad, he would frequently bring home with him poor people, and send them away clothed as well as fed. He took great pains to inform himself of the circumstances of his neighbours, that the modesty of the sufferer might not prevent his relief. But the money best laid out was, in his opinion, that which encouraged industry. It was one of his greatest pleasures to make up the losses of his laborious neighbours, and prevent their sinking under them. If a poor man had lost a beast, he would send him another in its room: or if any farmer had had a bad year, he would make him an abatement in his tythes. Thus, as far as he was able, he took the misfortunes of his parish upon himself; and, like a true shepherd, exposed himself for his flock. But of all kinds of industrious poor, he was most forward to assist those who had large families; such never failed to meet with his bounty, when they wanted to settle their children in the world.

In the distant parishes where he preached, as well as in his own neighbourhood, his generosity and benevolence were continually showing themselves; particularly in the desolate parts of Northumberland. "When he began his journey," says an old manuscript life of him, "he would have 10 pounds in his purse; and, at his coming home, he would be 20 nobles in debt, which he would always pay within a fortnight after." In the gaols he visited, he was not only careful to give the prisoners proper instructions, but used to purchase for them likewise what necessaries they wanted.

Even upon the public road, he never let slip an opportunity of doing good. He has often been known to take off his cloak, and give it to a half-naked traveller: and when he has had scarce money enough in his pocket to provide himself a dinner, yet would he give away part of that little, or the whole, if he found any who seemed to stand in need of it. Of this benevolent temper, the following instance is preserved. One day returning home he saw in a field several people crowding together; and judging something more than ordinary had happened, he rode up, and found that one of the horses in a team had suddenly dropped down, which they were endeavouring to raise; but in vain, for the horse was dead. The owner of it seemed much dejected with his misfortune; and declaring how grievous a loss it would be to him, Mr Gilpin bade him not be disheartened: "I'll let you have (says he), honest man, that horse of mine," and pointed to his servant's.—"Ah! master (replied the countryman), my pocket will not reach such a beast as that." "Come, come (said Mr Gilpin), take him, take him; and when I demand my money, then thou shalt pay me."

This worthy and excellent divine, who merited and obtained the glorious titles of *the Father of the Poor*, and the *Apostle of the North*, died in 1583, in the 66th year of his age.

GILTHEAD. See SPARUS, ICHTHYOLOGY *Index*.

GIN. See GENEVA.

GIN, in mechanics, a machine for driving piles, fitted with a windlass and winches at each end, where eight or nine men heave, and round which a rope is reeved that goes over the wheel at the top: one end of this rope is seized to an iron monkey, that hooks to a beetle, of different weights, according to the piles they are to drive, being from eight to thirteen hundred weight; and when hove up to a cross piece, near the wheel, it unhooks the monkey, and lets the beetle fall on the upper end of the pile, and forces the same into the ground: then the monkey's own weight overhauls the windlass, in order for its being hooked again to the beetle.

GINGER, the root of a species of amomum. See AMOMUM, BOTANY *Index*.

GINGIDIUM, a genus of plants, belonging to the pentandria class. See BOTANY *Index*.

GINGIRO, or ZINDERO, a small territory of Africa, to the south of Abyssinia; being separated from it by the river Zebee, by which it is also almost entirely surrounded. This river is extremely large, having more water than the Nile, and being much more rapid; so that, during the rainy season, it would be altogether impassable, were it not for the large rocks which are in its channel. The extreme difficulty which occurs in passing this river, however, is the means of preserving the kingdom of Gingiro, which would otherwise be conquered in a single season by the Galla.

The most remarkable particular with regard to this kingdom is, that the sovereign is a professed votary of the devil. "This superstition (says Mr Bruce) reaches down all the western side of the continent on the Atlantic ocean, in the countries of Congo, Angola, and Benin. In spite of the firmest foundation in true philosophy, a traveller, who decides from the information and investigation of facts, will find it very difficult to treat these appearances as absolute fictions, or as owing to the superiority of cunning of one man in overreaching another. For my own part, I confess, I am equally at a loss to assign reasons for disbelieving the fiction on which their pretensions to some preternatural information are founded, as to account for them by the operation of ordinary causes."

In this kingdom every thing is conducted, or pretended to be conducted, by magic; and all those slaves, which in other African countries are sold to Europeans, are here sacrificed to the devil, human blood being a necessary part in all their accursed solemnities. "How far (says Mr Bruce) this reaches to the southward, I do not know; but I look upon this to be the geographical bounds of the reign of the devil

devil on the north side of the equator in the peninsula of Africa."

With regard to this country, very little farther is known, than some of the customs of the people transiently picked up by the Jesuit missionaries in Abyssinia. From them we learn, that the kingdom is hereditary in one family, though it does not regularly descend to the eldest son, the king being chosen by the nobles; in which they resemble their neighbours the Abyssinians. When the king dies, his body is wrapped in a fine cloth, and a cow is killed. The body so wrapped up is next enclosed in the cow's skin; and all the princes of the royal family fly and hide themselves in the bushes, while those who are intrusted with the election enter the thickets, beating about everywhere as if for game. At last a bird of prey, called in their language *liber*, appears, and hovers over the person destined to be king; crying and making a great noise without quitting his station. By this means the person destined to be elected is found out, surrounded, as is reported, by lions, tigers, panthers, and other wild beasts; all which are supposed to be brought by the power of magic or of the devil.—After the king is found, he flies upon those who came in quest of him with great fury, killing and wounding as many as he can reach, until at last he is dragged to the throne whether he will or not. One particular family have the privilege of conducting him to the throne; and if they should not happen to find him at first, they have a right to take him out of the hands of those who did so; and thus another battle ensues before the vacant throne can be filled. Lastly, Before he enters his palace, two men must be killed; one at the foot of a tree by which the house is supported; and the other at the threshold of the door, which is besmeared with the blood of the victim. It is the particular privilege of one family to afford these victims; and so far are they from seeking to avoid this fate, that they glory in the occasion, and willingly offer themselves to meet it. This last particular, Mr Bruce says, he had in Abyssinia from people coming from Gingiro.

GINGIVÆ, the gums. See GUMS.

GINGLYMUS, in *Anatomy*, one of the species of articulation. It is that jointure of the bones where each bone mutually receives the other; so that each bone both receives and is received. See ANATOMY *Index*.

GINKGO, the MAIDEN-HAIR TREE. See MAURITIA, BOTANY *Index*.

GINORA, a genus of plants belonging to the dodecandria class, and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

GINSENG. See PANAX, BOTANY and MATERIA MEDICA *Index*.

GIOIA, FLAVIO, of Amalfi, in the kingdom of Naples, the celebrated mathematician; who, from his knowledge of the magnetic powers, invented the mariner's compass, by which the navigation of the Europeans was extended to the most distant regions of the globe: before this invention, navigation was confined to coasting. The king of Naples being a younger branch of the royal family of France, he marked the north point with a fleur-de-lis, in compliment to that country. It is said the Chinese knew the compass long before; be this as it may, the Europeans are indebted to Gioia for this invaluable discovery. He flourished A. D. 1300.

GIORDANA, LUCA. See JORDANO.

GIORGIONE, so called from his comely aspect, was an illustrious Venetian painter, born in 1478. He received his first instructions from Giovanni Bellino; but studying afterwards the works of Leonardo da Vinci, he soon surpassed them both, being the first among the Lombards who found out the admirable effects of strong lights and shadows. Titian became his rival in this art; and was so careful in copying the life, that he excelled Giorgione in discovering the delicacies of nature, by tempering the boldness of his colouring. The most valuable piece of Giorgione in oil is that of Christ carrying his cross, now in the church of San Rovo in Venice; where it is held in great veneration. He died of the plague young, in 1511.

GIRAFFE. See CERVUS, MAMMALIA *Index*.

GIRALD, BARRY, or *Giraldus Cambrensis*. See BARRY.

GIRALDI, LILIO GREGORIO, an ingenious critic, and one of the most learned men that modern Italy has produced, was born at Ferrara in 1479. He was at Rome when it was plundered by the emperor Charles V.; and having thus lost all he had, and being tormented by the gout, he struggled through life with ill fortune and ill health. He wrote, neverthless, 17 performances, which were collected and published at Basil in 2 vols. folio in 1580, and at Leyden in 1696. Authors of the first rank have bestowed the highest eulogies on Giraldus; particularly Casaubon and Thuanus.

GIRALDI, *John Baptist Cintio*, an Italian poet of the same family with the foregoing Lilio, was born in 1504. He was secretary to the duke of Ferrara, and afterwards became professor of rhetoric at Pavia. He died in 1573. His works, which consist chiefly of tragedies, were collected and published at Venice by his son Celso Giraldi, in 1583; and some scruple not to rank him among the best tragic writers Italy has produced.

GIRARDON, FRANCIS, a celebrated French architect and sculptor, born at Troyes in 1627. Louis XIV. being informed of his great talents, sent him to Rome with a pension of 1000 crowns. At his return into France, he laboured for the royal palaces and the gardens of Versailles and Trianon; where there are many of his works executed in bronze and in marble, from the designs of Charles le Brun. The mausoleum of Cardinal de Richelieu, in the Sorbonne, and the equestrian statue of Louis XIV. at the Place de Vendome, where the statue and horse are cast in one piece, pass for his most excellent performances. Girardon was professor, rector, and chancellor, of the Academy of Painting and Sculpture; and had the post of inspector general of all the works done in sculpture. He died in 1715.

GIRDERS, in *Architecture*, the largest pieces of timber in a floor. Their ends are usually fastened into the summers, or brest summers; and the joists are framed at one end to the girders.

By the statute for rebuilding London, no girder is to to be less than ten inches into the wall, and their ends to be always laid in loam, &c.

GIRDLE (*Cingulus* or *Zona*), a belt or band of leather or other matter, tied about the reins, to keep that part more firm and tight.

It was anciently the custom for bankrupts and other insolvent debtors to put off and surrender their girdle in open court. The reason of this was, that our ancestors used to carry all their necessary utensils, as purse, keys, &c. tied to the girdle; whence the girdle became a symbol of the state. History relates that the widow of Philip I. duke of Burgundy, renounced her right of succession by putting off her girdle upon the duke's tomb.

The Romans always wore a girdle to tuck up the tunica when they had occasion to do any thing: this custom was so general, that such as went without girdles, and let their gowns hang loose, were reputed idle dissolute persons.

Maiden's or *Virgin's* GIRDLE. It was a custom among the Greeks and Romans for the husband to untie his bride's girdle. Homer, lib. xi. of his Odyssey, calls the girdle παρθενιην ζωνην, *maid's girdle*. Festus relates, that it was made of sheep's wool, and that the husband untied it in bed; he adds, that it was tied in the Herculanean knot; and that the husband unloosed it, as a happy presage of his having as many children as Hercules, who at his death left seventy behind him.

The poets attribute to Venus a particular kind of girdle called *cestus*, to which they annexed a faculty of inspiring the passion of love.

GIRGASHITES, or GERGESENES, an ancient people of the land of Canaan, whose habitation was beyond the sea of Tiberias, where we find some footsteps of their name in the city of *Gergesa*, upon the lake of Tiberias. The Jewish doctors inform us, that when Joshua first came into the land of Canaan, the Girgashites took a resolution rather to forsake their country than submit to the Hebrews, and accordingly retired into Africa. Nevertheless, it is certain that a good number of them staid behind, since Joshua (xxiv. 11.) informs us that he subdued the Girgashites, and they whom he overcame were certainly on this side Jordan.

GIRGENTI, a town of Sicily, which occupies part of the site of the ancient *Agrigentum*. It has only one street fit for carriages. It is inhabited by 15,000 persons; but has no remarkable buildings or works of art that deserve mention: the only antiquities to be seen were a Latin inscription of the time of the Antonines, as is pretended, relative to some association between Agrigentum and Lilybæum; and a piece of ancient masonry in the foundations of a church pretended to be the remains of a temple of Jupiter. At some distance, on the old ground in the vale, stands the cathedral, a clumsy building patched up by barbarous architects with various discordant parts. This church is enriched with no works of modern painters or sculptors that claim any title to praise, but the baptismal font is made out of an ancient sarcophagus faced with very beautiful basso relievos. This see is the richest in Sicily, but has the character of being less enlightened and polished than the rest of the island. Among the curiosities belonging to the cathedral is an Etruscan vase of rare size and preservation. There are also some golden pateras of extreme rarity. The monastery of San Nicolo stands on a little eminence in the centre of the old city, admirably situated. The range of hills towards the south-east sinks gradually, so as to admit a noble reach of sea and of plain, terminated on each side by thick groves of fruit trees. Above appear the remains of ancient grandeur, wonderfully contrasted with the humble straw cottages built at their feet. In the orchard of this convent is a square building with pilasters, which is supposed to have been part of the palace of the Roman prætor.

Girgenti has the convenience of a port; for which, however, it is less indebted to its natural situation than to the recent assistance of art. The harbour is formed by means of a pier carried out in three sides of an octagon, with a battery at the head; the lighthouse is to be erected on the cliffs on shore, as there is no possibility of raising it high enough on the mole without danger of sinking. The work is admirable as to strength and neatness, but the intention of creating a safe and complete haven has not been fully answered; the Sirocco commands it entirely, and drives in great quantities of sand, which it is feared will in time choke up the port; even now ships of burden find it difficult to get in, but the Caricatore is considerable, and the magazines in the rocks along the shore are very spacious.

GIRONNE, or GIRONNY, in *Heraldry*, a coat of arms divided into girons, or triangular figures, meeting in the centre of the shield, and alternately colour and metal.

GIRT, the situation of a ship which is moored so strait by her cables, extending from the *hawse* to two distant anchors, as to be prevented from swinging or turning about according to any change of the wind or tide, to the current of which her head would otherwise be directed. The cables are extended in this manner, by a strong application of mechanical powers within the ship; so that when she veers, or endeavours to swing about, her side bears upon one of the cables, which catches on her heel, and interrupts her in the act of traversing. In this position she must ride with her broadside to the wind or current, till one or both of the cables are slackened.

GISCO, son of Himilco the Carthaginian general, was banished from Carthage by the influence of his enemies. Being afterwards recalled, he was made general in Sicily against the Corinthians, about 309 years before the Christian era, and by his success and intrepidity he obliged the enemies of his country to sue for peace. See CARTHAGE.

GISBOROUGH, a town of England, in the west riding of Yorkshire, on the road from Whitby to Durham, 224 miles from London, and four miles from the mouth of the Tees, where is a bay and harbour for ships. It had formerly an abbey, which was once the common burial place of the nobility of these parts, and its church by the ruins seems to have been equal to the best cathedrals in England. The soil, besides its fertility in pasture and a constant verdure adorned with plenty of field flowers almost all the year, has earths of sundry colours, some iron, and mines of alum, which were first discovered in the reign of King James I. and have been since very much improved. Sir Paul

Pindar, who first farmed them, paid rents to the king 12,500l. to the Earl Musgrave 1640l. and to Sir William Penniman 600l. and had moreover 800 men by sea and land in constant pay; yet he was a considerable gainer, because there was then scarce any other to be had, and the price was 26l. a ton; but now there are several other alum works in this county, which have taken a great part of the trade from hence; so that the works here have for some years lain neglected. Population 1834 in 1811.

GITTITH, a Hebrew word occurring frequently in the Psalms, and generally translated *wine presses.* The conjectures of interpreters are various concerning this word. Some think it signifies a sort of musical instrument; others, that the psalms with this title were sung after the vintage; lastly, others, that the hymns of this kind were invented in the city of Gath. Calmet is rather of opinion, that it was given to the class of young women or songstresses of Gath to be sung by them, Psal. viii. 1. lxxxi. 1. lxxxiv. 1. Dr Hammond thinks that the psalms with this title were all set to the same tune, and made on Goliath the Gittite.

GIULA, a strong town of Upper Hungary, on the frontiers of Transylvania. It was taken by the Turks in 1566, and retaken by the Imperialists in 1596. It is seated on the river Keresblan, in E. Long. 21. 1. N. Lat. 46. 25.

GIUSTANDEL, a large and strong town of Turkey in Europe, and in Macedonia, with a Greek archbishop's see. It is seated near the lake Ochrida, in E. Long. 20. 50. N. Lat. 41. 10.

GLACIERS, a name given to some very extensive fields of ice among the ALPS. Mr Coxe observes of these mountains in general, that they are composed of many parallel chains, the highest of which occupy the centre, and the others gradually diminish in proportion as we recede from thence. The central chain appears covers with pointed rocks; all parts of which, that are not absolutely perpendicular, lie hid under perpetual snow and ice even in summer. On each side of this ridge are fertile and cultivated valleys, interspersed with numerous villages, and watered by numerous streams. The elevated peaks of the central chain are covered with snow: but their declivities, excepting those that are extremely steep, have all a covering of ice as well as snow; the intermediate parts being filled with vast fields of ice, terminating in the cultivated valleys above mentioned. The same phenomena, though on a smaller scale, occur in those chains that are at a distance from the principal one: In those which are most remote, no ice, and scarcely any snow, is observed, unless upon some of the most elevated summits; and the mountains diminishing in height and ruggedness, appear covered with verdure, until at last they terminate in small hills and plains.

Thus the glaciers may be divided into two sorts; one occupying the deep valleys situated in the bosom of the Alps, and distinguished by the name of Ice valleys; the others are those which clothe the declivities and sides of the mountains. These two kinds of glaciers are distinguished by Mr Coxe into the upper and lower glaciers.

The lower glaciers are by far the most considerable; some of them extending several leagues in length. They do not communicate with each other, as has been generally supposed, few of them being parallel to the central chain; but, stretching mostly in a transverse direction, are bordered at the higher extremity by inaccessible rocks, and at the lower extending into the cultivated valleys. The thickness of the ice varies in different parts. In the glacier des Bois, which extends more than 15 miles in length, and upwards of three in breadth, M. Saussure found it generally from 80 to 100 feet; but he was credibly informed, that in some places it was not less than 600 feet, and even more. These vast masses of ice usually rest on an inclined plane; where, being pushed forward by their own weight, and but weakly supported by the rugged rocks beneath them, they are intersected by large crevices, and have an appearance of walls, pyramids, &c. according to the position of the eye in viewing them. In those parts, however, where they lie upon even ground, or such as has only a gentle inclination, the surface of the ice is nearly uniform, the crevices being few and narrow, and the glacier being crossed by travellers on foot without any difficulty. The surface of the ice is rough and granulated, so that people may walk upon it, excepting such places as have a steep descent. It is opaque, full of small bubbles about the size of a pea, very porous, and greatly resembles a mixture of snow and water congealed. A vast quantity of stones and earth falls down from the mountains upon the glaciers, and are by them thrown off on each side according to the descent of the ice, as will be afterwards explained. The place on which these rest is more hard and elevated than the rest of the ice, and is very difficult to walk upon; the earth is likewise laid upon them in such regular heaps, that it appears to have been done by art. This collection of earths and stones is termed by the natives the *Moraine.*

Mr Coxe, who visited the glacier des Bois, informs us, that the appearance of it at a distance was so tremendous, that it seemed impracticable to cross it. Numerous and broad chasms intersected it in every direction; but entering upon it, the company found that courage and activity were only required to accomplish the task. They had large nails in their shoes, and spiked sticks; which on this occasion were found to be particularly serviceable. Having passed the moraine, and descended upon the glacier itself, they found the ice softened by a warm wind which rendered it less slippery than usual. Having walked across it for about a quarter of an hour, they came again to the moraine, along which they continued their journey for half an hour, and then entered upon the great body of the glacier. "Here (says Mr Coxe) it was curious to observe the numerous little rills produced by the collection of drops occasioned by the thawing of the ice on the upper part of the glacier: these little rills hollow out small channels, and, torrent-like, precipitate themselves into the chasms, with a violent noise, increasing the body of waters formed by the melting of the interior surface, and finding an outlet under the immense arch of ice in the valley of Chamouni, from which the Arveron rushes." As our traveller proceeded on his journey, he was surprised by the noise of a large fragment of rock which had detached itself from one of the highest needles, and bounded from one precipice to another with great rapidity; but before it reached the plain, it was almost reduced to dust. "Having proceeded about an hour (says

Glaciers. (says he) we were astonished with a view more magnificent than imagination can conceive: hitherto the glaciers had scarcely answered my expectations, but now they far surpassed them. Nature had clad herself in all her terrors. Before us was a valley of ice 20 miles in extent, bounded by a circular glacier of pure unbroken snow, named Takul, which leads directly to the foot of Mount Blanc, and is surrounded by large conical rocks, terminating in sharp points like the towers on an ancient fortification; to the right rose a range of magnificent peaks, the intervals filled with glaciers; and far above the rest, the magnificent summit of Mount Blanc, his highest point obscured with clouds. He appeared of such immense magnitude, that, at his presence, the circumjacent mountains, however gigantic, seemed to shrink before him, and *hide their diminished heads.* In half an hour we arrived at the moraine, which forms a boundary of the valley, crossed it, and proceeded upou a body of ice about three quarters of a mile broad. Here the ice was more even and free from chasms than in the great valley. We then passed a second moraine, and beyond that another mass of ice to a third moraine: descending from thence we came upon the last ridge of ice, broader considerably than the two former, and full of large chasms: it separated from the rock only by a very narrow moraine. These moraines contain great quantities of crystal."

They continued to ascend the valley of ice, the scene constantly increasing in magnificence and horror; and having walked about five miles on the ice, they arrived at last at the foot of the eminence named *Couvercle*, where they were obliged to quit the ice. The doing this was extremely dangerous, and at one place very tremendous. It was a bulging smooth rock, with a precipice of considerable depth terminated by a vast crevice in the ice, which seemed to stop all further progress; a small hollow in the middle, however, afforded room for one foot; and having fixed this, they sprung over to the other side, being helped and directed by the guides who went over first. Having gained the top of the Couvercle, they had a view of three of the glaciers, viz. that of *Talefre* to the left *l'Echaut*, in front, and *Takul* on the right; all uniting in that great one called the *Glacier de Bois*. The Couvercle itself is a most extraordinary rock, having the appearance of a large irregular building with many sides; the substance of which is granite. Having reached the top, they were surprised with a thunder storm, from which they took shelter under an impending rock. The view was exceedingly magnificent; the glaciers appearing like a rugged expanse of frozen sea bounded by gigantic rocks, and terminated by Mount Blanc. A single rock appeared of a triangular figure covered with Alpine plants; and which by reason of its contrast with the rugged and snowy mountains in the neighbourhood, has obtained the name of the *Garden*. During this, as well as other excursions among the Alps, Mr Coxe had occasion to observe that the colour of the sky was of a much deeper blue than in the lower regions.

The upper glaciers may be subdivided into those which cover the summits, and those which extend along the sides of the Alps. Those on the very summit, however, though they have the appearance of ice, are not so in reality, but consist entirely of snow hardened by the extreme cold. M. Saussure found that which covered the top of Mount Blanc to be penetrable, though with difficulty, by a stick; but below this hard crust was a soft snow without coherence. The sides are covered with a mixture of ice and snow; by reason of the superior power of the summer sun to dissolve the snow, which afterwards congeals into hard ice.

Glaciers.

Several conjectures have been made concerning the formation of these extraordinary bodies of ice. Mr Coxe agrees with M. Gruner in opinion, that they are produced by the continual dissolution of the snow in summer, and its congelation by the succeeding frosts. Hence, on the snmmits of the mountains where the sun has very little power, the glacier is soft, and contains no ice: as we descend the mountains the consistence becomes firmer, because there is a considerable mixture of snow water, the congelation of which augments the hardness; and in the valleys, the glacier is hardest of all, because the portion of water is there much superior to that of the snow. Hence it seems plain that the glaciers derive their origin from the melting of the snow on the upper parts of the mountains, and the congelation of the water as it advauces: and to this cause M. Saussure adds the quantity of snow which often rolls down into the valleys, and congeals along with the water just mentioned.

Another question concerning the glaciers naturally occurs, namely, Whether they are to be considered as in a state of increase or diminution? Mr Coxe is of opinion, that they occasionally increase and decrease; in proof of which he adduces the following observation: "The borders of the glacier of Montanvert are mostly skirted with trees: towards its base a vast arch of ice rises to near 100 feet in height; under which the river Arveron rushes with considerable force, and in a large body of water. As we approached the ice, we passed through a wood of firs: those trees which stand at a little distance from the arch are about 80 feet high, and are undoubtedly of a very great age. Between these and the glacier the trees are of a later growth; as is evident from their texture and inferior size. Others, still smaller, have been overturned and enveloped in the ice: there seems to be a kind of regular gradation in the age of these several trees, from the largest which are standing to the smallest that lie prostrate."—Hence our author concludes, that the glacier once extended as far as the row of small firs; but that upon its gradual dissolution, a number of trees shot up on the spot it had occupied; since which time the ice has again advanced, and overturned the last grown trees before they had attained to any considerable height.—This he thinks also confirmed by the following fact.—"Large stones of granite are usually found at a small distance from the extremities of the glacier. These stones have certainly fallen from the mountains upon the ice; have been carried on in its progress; and have tumbled into the plain upon the dissolution or sinking of the ice which supported them. These stones, which the natives call *Moraine*, form a kind of border towards the foot of the valley of ice, and have been pushed forward by the glacier in its advances: they extend even to the place occupied by the larger pines."

In opposition to those who maintain that there is a constant accumulation of ice and snow in the Alpine regions, our author makes the following remarks: 1. Between the years 1776 and 1785 the glacier of

 Grindelevald

Grindelevald had diminished to such a degree, that the spot which its extremity occupied in the former year, was at least 400 paces from that occupied by it in the latter. 2. In the year 1785 the Murailles de Glace, which in 1776 he had described as forming the border of the glacier of Bosson no longer existed; and young trees had shot up in the parts which were then covered by the glacier of Montanvert. Still, however, it may be urged, that these changes only take place in the valleys where the power of the sun is considerable; and that from thence we cannot form any adequate idea of what passes in the more elevated regions, where in all probability more snow falls than can be dissolved. In support of this opinion, it is alleged, that the cold produced by the mass of ice already formed ought to augment it still more; and that within the memory of the present generation, many places have been covered with ice which were not so before. To these arguments, however, Mr Coxe replies, that the causes, which diminish the ice in the upper regions, are no less powerful than the cold which tends to augment it. These are, 1. Rain or sleet; which falling upon the lower glaciers, thaw the ice, increase the rills on its surface, excavate channels, and in many ways tend to diminish its quantity. 2. Evaporation, which takes place even from the surface of the ice itself, acts still more powerfully; and its action is not confined to any particular season. 3. The falling of the snow and ice; both that which comes gradually from the clouds; and that which descends from the mountains in great masses, called by the natives *avalanches*. When these last fall down into milder regions, though sometimes they may resist the influence of the sun and form ice valleys, yet they generally dissolve. They are most common in the upper glaciers, though sometimes they descend upon the lower, while the gradual descent of snow from the clouds, which chiefly takes place in the lower, contributes very much to lessen the mass. 4. All the lower glaciers or valleys of ice rest on an inclined plane, are hollow, and undermined by torrents which are constantly flowing from the upper glaciers, as well as from their own lowermost surface. Their foundation being thus constantly diminishing, the lower glaciers are carried imperceptibly forward into the cultivated fields, where an end is necessarily put to their progress by the heat of the sun. Hence we may see the reason of that strange phenomenon taken notice of by Mr Coxe, that with one hand he could touch ripe corn, and with the other solid ice. This descent of the glacier is demonstrable from the trees overturned by it, and the moraine always observed at the bottom of the lower glaciers. 5. The heat of the sun is an evident cause of the diminution of the glaciers. To this Mr Coxe adds another cause less generally known, viz. the warm winds which blow by night as well as by day both in the upper and lower glaciers. "These warm winds (says he) are during summer so common in those parts, that I never crossed a glacier without feeling in some particular positions a warmth similar to the air of a hot bath." 6. Another cause is the mean temperature of the earth itself; which, where it is not exposed to the piercing cold of the atmosphere, is found to have a temperature always above the freezing point. As the vast thickness of the superincumbent ice, therefore, is in the present case abundantly sufficient to prevent the access of the atmosphere, it is plain that the lower surface of it must, by being in contact with the earth, continually decay.—With regard to the other argument drawn from the known increase of the ice in some places, Mr Coxe does not deny it; but insists, that there is no continual increase of the whole, but that if it increases in some places, it diminishes in others; and his opinion in this respect was confirmed by those who frequent the mountains.

GLACIS, in building, an easy insensible slope or declivity.

The descent of the glacis is less steep than that of the talus. In gardening, a descent sometimes begins in talus, and ends in glacis.

The glacis of the corniche, is an easy imperceptible slope in the cymatium, to promote the descent and draining off the rain water.

Glacis, in *Fortification*, that mass of earth which serves as a parapet to the covered way, sloping easily towards the champaign or field.

GLADE, in *Gardening* and *Agriculture*, an opening and light passage made through a wood, by lopping off the branches or trees along that way.

GLADIATORS, in antiquity, persons who fought, generally in the arena at Rome, for the entertainment of the people,

The gladiators were usually slaves, and fought out of necessity; though sometimes freemen made profession thereof, like our prize-fighters, for a livelihood.

The Romans borrowed this cruel diversion from the Asiatics: some suppose that there was policy in the practice, the frequent combats of gladiators tending to accustom the people to despise dangers and death.

The origin of such combats seems to be as follows: From the earliest times with which we have any acquaintance in profane history, it had been the custom to sacrifice captives, or prisoners of war, to the manes of the great men who had died in the engagement; thus Achilles, in the Iliad, lib. xxiii. sacrifices twelve young Trojans to the manes of Patroclus; and in Virgil, lib. xi. ver. 81. Æneas sends captives to Evander, to be sacrificed at the funeral of his son Pallas.

In course of time they came also to sacrifice slaves at the funerals of all persons of condition: this was even esteemed a necessary part of the ceremony; but as it would have appeared barbarous to have massacred them like beasts, they were appointed to fight with each other, and endeavour to save their own lives by killing their adversary. This seemed somewhat less inhuman, because there was a possibility of avoiding death, by an exertion of skill and courage.

This occasioned the profession of gladiator to become an art: hence arose masters of the art, and men learned to fight and exercise. These masters, whom the Latins called *lanistæ*, bought them slaves to be trained up to this cruel trade, whom they afterwards sold to such as had occasion to present the people with so horrible a show.

These exhibitions were at first performed near the sepulchre of the deceased, or about the funeral pile; but were afterwards removed to the circus and amphitheatres, and became ordinary amusements.

The first show of gladiators, called *munus gladiatorium*, was exhibited at Rome, according to Valerius Maximus, by

Gladiators.

by M. and D. Brutus, upon the death of their father, in the year of the city 490. On this occasion there were probably only three pair of gladiators. In 537 the three sons of M. Æmilius Lepidus the augur, who had been three times consul, entertained the people with the cruel pleasure of seeing 22 gladiators fight in the forum. In 547, the first Africanus diverted his army at New Carthage with a show of gladiators, which he exhibited in honour of his father and uncle, who had begun the reduction of Spain. In process of time, the Romans became so fond of these bloody entertainments, that not only the heir of any great and rich citizen lately deceased, but all the principal magistrates, presented the people with shows of this nature, to procure their affection. The ædiles, prætors, consuls, and, above all, the candidates for offices, made their court to the people, by entertaining them frequently with these fights: and the priests were sometimes the exhibitors of the barbarous shows; for we meet with the *ludi pontificales* in Suetonius, August. cap. 44. and with the *ludi sacerdotales*, in Pliny, Epist. lib. vii. As for the emperors, it was so much their interest to ingratiate themselves with the populace, that they obliged them with combats of gladiators almost upon all occasions; and as these increased, the number of combatants increased likewise. Accordingly, Julius Cæsar, in his ædileship, diverted the people with 320 couple. Titus exhibited a show of gladiators, wild beasts, and representations of sea fights, which lasted 100 days; and Trajan continued a solemnity of this nature for 123 days; during which time he brought out 1000 pair of gladiators. Before this time, under the republic, the number of gladiators was so great, that when the conspiracy of Catiline broke out, the senate ordered them to be dispersed into the garrisons and secured, lest they should have joined the disaffected party. See GLADIATORS *War*.

These sports were become so common, and their consequences in a variety of respects so dangerous, that Cicero preferred a law that no person should exhibit a show of gladiators within two years before he appeared candidate for any office. Julius Cæsar ordered, that only a certain number of men of this profession should be in Rome at a time; Augustus decreed, that only two shows of gladiators should be presented in a year, and never above sixty couple of combatants in a show; and Tiberius provided by an order of senate, that no person should have the privilege of gratifying the people with such a solemnity unless he was worth 400,000 sesterces. They were also considerably regulated by Nerva.

The emperor Claudius restrained them to certain occasions; but he soon afterwards annulled what he decreed, and private persons began to exhibit them at pleasure as usual; and some carried the brutal satisfaction so far as to have them at their ordinary feasts. And not slaves only, but other persons, would hire themselves to this infamous office.

The master of the gladiators made them all first swear that they would fight to death; and, if they failed, they were put to death either by fire, or swords, clubs, whips, or the like.

It was a crime for the wretches to complain when they were wounded, or to ask for death or seek to avoid it when overcome; but it was usual for the emperor or the people to grant them life when they gave no signs of fear, but waited the fatal stroke with courage and intrepidity: Augustus even decreed that it should always be granted them.

From slaves and freemen the inhuman sport at length spread to people of rank and condition; so that Augustus was obliged to issue a public edict that none of the senatorian order should become gladiators; and soon after he laid the same constraint on the knights: nevertheless Nero is related to have brought upwards of 400 senators and 600 Roman knights upon the arena; though Lipsius takes both these numbers to be falsified, and not without reason reduces them to 40 senators and 60 knights: yet Domitian, that other monster of cruelty, refined upon Nero, exhibiting combats of women in the night time.

Constantine the Great is said to have first prohibited the combats of gladiators in the East. At least he forbade those who were condemned to death for their crimes to be employed; there being an order still extant to the *præfectus prætorii* rather to send them to work in the mines in lieu thereof; it is dated at Berytus in Phœnicia, the first of October 325.

The emperor Honorius forbade them at Rome on occasion of the death of Telemachus, who coming out of the East into Rome at the time of one of these spectacles, went down into the arena, and used all his endeavours to prevent the gladiators from continuing the sport; upon which the spectators of that carnage, fired with anger, stoned him to death. It must be observed, however, that the practice was not entirely abolished, in the West before Theodoric king of the Ostrogoths. Honorius, on the occasion first mentioned, had prohibited them; but the prohibition does not seem to have been executed. Theodoric, in the year 500, abolished them finally.

Some time before the day of combat, the person who presented the people with the shows gave them notice thereof by programmas or bills, containing the names of the gladiators, and the marks whereby they were to be distinguished: for each had his several badge; which was most commonly a peacock's feather, as appears from the scholiast of Juvenal on the 158th verse of the third satire, and Turnebus Advers. lib. ii. cap. 8. They also gave notice how long the shows would last, and how many couples of gladiators there were; and it even appears, from the 52d verse of the seventh satire of the second book of Horace, that they sometimes made representations of these things in painting, as is practised among us by those who have any thing to show at fairs.

The day being come, they began the entertainment by bringing two kinds of weapons; the first were staves or wooden foils, called *rudes;* and the second were effective weapons, as swords, poniards, &c. The first were called *arma lusoria*, or *exercitoria;* the second *decretoria*, as being given by decree or sentence of the prætor, or of him at whose expence the spectacle was exhibited. They began to fence or skirmish with the first, which was to be the prelude to the battle; and from these, when well warmed, they advanced to the second at the sound of the trumpets, with which they fought naked. Then they were said *vertere arma*. The terms of striking were *petere et repetere;* of avoiding a blow, *exire;* and

and when one of the combatants received a remarkable wound, his adversary or the people cried out, *Habet*, or *Hoc habet.* The first part of the engagement was called *ventilare, prœludere;* and the second *dimicare ad certum*, or *versis armis pugnare:* and some authors think, with much probability, that it is to these two kinds of combat that St Paul alludes in the passage 1 Cor. ix. 26, 27. "I fight not as one that beateth the air; but I keep my body, and bring it into subjection."

If the vanquished surrendered his arms, it was not in the victor's power to grant him life; it was the people during the time of the republic, and the prince or people during the time of the empire, that were alone empowered to grant the boon. The reward of the conqueror was a branch of palm tree, and a sum of money, probably collected among the spectators: sometimes they gave him his congé, or dismissed him by putting one of the wooden foils or *rudes* in his hand; and sometimes they even gave him his freedom, putting the pilæus on his head. The sign or indication, whereby the spectators showed that they granted the favour, was *premere pollicem*, which M. Dacier takes to be a clenching of the fingers of both hands between one another, and so holding the two thumbs upright close together; and, when they would have the combat finished and the vanquished slain, *verterunt pollicem*, they bent back the thumb; which we learn from Juvenal, Sat. iii. ver. 36. The gladiators challenged or defied each other, by showing the little finger; and, by extending this, or some other, during the combat, they owned themselves vanquished, and begged mercy from the people: *Victi ostensam digiti veniam à populo postulabant*, says the old scholiast on Persius.

There were various kinds of gladiators, distinguished by their weapons, manner, and time of fighting, &c. as, The *andabatœ*, mentioned under ANDABATÆ. The *catervarii*, who always fought in troops or companies, number against number; or, according to others, who fought promiscuously, without any certain order. The *dimachœ*, who fought armed with two poniards or swords, or with sword and dagger. The *essedarii*, who fought in cars. The *fiscales*, or *Cæsariani*, who belonged to the emperor's company; and who, being more robust and dexterous than the rest, were frequently called for, and therefore named also *postulatitii.* Several other kinds are mentioned in the ancient authors.

GLADIATORS *War* (*bellum Gladiatorium* or *Spartacum*), called also the *servile war*, was a war which the Romans sustained about the year of their city 680. Spartacus, Crinus, and Oenomaus, having escaped, with other gladiators to the number of seventy-four, out of the place where they had been kept at Capua, gathered together a body of slaves, put themselves at their head, rendered themselves masters of all Campania, and gained several victories over the Roman prætors. At length they were defeated in the year 862, at the extremity of Italy; having, in vain, attempted to pass over into Sicily.

This war proved very formidable to the Romans. Crassus was not able to finish it: the great Pompey was forced to be sent as general.

The Dying GLADIATOR, a most valuable monument of ancient sculpture, which is now preserved in the palace of Chighi. This man, when he had received the mortal stroke, is particularly careful *ut procumbat honestè*, "that he might fall honourably." He is seated in a reclining posture on the ground, and has just strength sufficient to support himself on his right arm: and in his expiring moments it is plainly seen, that he does not abandon himself to grief and dejection; but is solicitous to maintain that firmness of aspect which the gladiators valued themselves on preserving in this season of distress, and that attitude which they had learnt of the masters of defence. He fears not death, nor seems to betray any tokens of fear by his countenance, nor to shed one tear: *quis mediocris gladiator ingemuit, quis vultum mutavit unquam, quis non modo stetit, verum etiam decubit turpiter*, says Cicero, in that part of his Tusculan where he is describing the astonishing firmness of those persons. We see, in this instance, notwithstanding his remaining strength, that he has but a moment to live; and we view him with attention, that we may see him expire and fall: thus the ancients knew how to animate marble, and give it almost every expression of life.

GLADIOLUS, CORN FLAG, a genus of plants belonging to the triandria class, and in the natural method ranking under the sixth order, *Ensatœ.* See BOTANY *Index*.

GLAIR of eggs, is the same as the white of eggs, and is used as a varnish for preserving paintings. For this purpose it is beat to an unctuous consistence, and commonly mixed with a little brandy or spirit of wine, to make it work more freely, and with a lump of sugar to give it body and prevent its cracking: and then spread over the picture or painting with a brush.

GLAMORGANSHIRE, a county of South Wales, said to have derived its name from a contraction of the Welsh words *Gwald Morgan*, or "the county of Morgan," and supposed to have been thus called from a prince of this part of the country, said to have been killed 800 years before the birth of our Saviour: but some other writers derive the name from the word *Mor*, which in the British tongue signifies the *sea;* this being a maritime county. It is bounded on the south and part of the west, by Bristol channel; on the north-west, by Caermarthenshire; on the north by Brecknockshire; and on the east, by Monmouthshire. It extends 48 miles in length from east to west, 27 in breadth from north to south, and is 116 in circumference. It is divided into 10 hundreds, in which are one city, 7 market towns, 118 parishes, 17,758 houses, and, in 1811, 85,067 inhabitants. It is in the diocese of Llandaff. This county, in the time of the Romans, was part of the district inhabited by the Silures, and had several Roman stations. Thus Boverton, a few miles to the south of Cowbridge, is supposed to be the Bovium of Antoninus: Neath to be his Nidum; and Loghor, to the west of Swansey, to be his Leucarum. The principal rivers of this county are the Rhymny, the Taff, the Ogmore, the Avon, the Cledaugh, and the Tave. The air, in the south part, towards the sea, is temperate and healthful; but the northern part, which is mountainous, is cold and piercing, full of thick woods, extremely barren, and thin of inhabitants. The mountains, however, serve to feed herds of cattle, and send forth streams which add greatly to the fertility of the other parts of the county:

Glamorganshire ‖ Glaris.

county: they have likewise coal and lead ore. The south part is so remarkably fertile, pleasant, and populous, that it is generally styled the garden of Wales; but it has no manufacture. This county was formerly full of castles, most of which are now fallen to decay. It has many small harbours on the coast for exporting coals and provisions. Of the former it sends large quantities both to England and Ireland; but of the latter, to England almost solely, especially butter. It sends two members to parliament, one for the shire, and one for the borough of Cardiff the capital. See GLAMORGANSHIRE, SUPPLEMENT.

GLAMOUR, or GLAMER, an old term of popular superstition in Scotland, denoting a kind of magical mist believed to be raised by sorcerers, and which deluded their spectators with visions of things which had no real existence, altered the appearance of those which really did exist, &c.—The eastern nations have a similar superstition, as we may learn from the Arabian Nights Entertainments and other works of oriental fiction.

GLAND, in *Anatomy*. See ANATOMY *Index*.

GLANDERS. See FARRIERY *Index*.

GLANDORE, a town of Ireland, situated in the county of Cork and province of Munster, near the harbour of that name.

GLANDORE Harbour, situated two leagues west of the Galley-head in the county of Cork, province of Munster, N. Lat. 51. 22. W. Long. 8. 56. Between this harbour and Ross the coast continues high and bold, with only two small coves; that to the east called *Millcove*, and that to the west *Cowcove*. This harbour lies three miles west of Ross; and though small, is an exceeding good one; near it is a castle of the same name, and on the upper end is a deep and dangerous glin, called the *Leap*. Glandore gives title of earl to the family of Crosbie.

GLANDULÆ RENALES. See ANATOMY *Index*.

GLANS, in *Anatomy*, the tip or button of the penis, or that part covered with the prepuce, called also *balanus*. See ANATOMY *Index*.

GLANS is also used to denote the tip or extremity of the clitoris, from its resemblance, both in form and use, to that of the penis. See ANATOMY *Index*.

GLANVIL, JOSEPH, a learned and ingenious, but fanciful and credulous, writer in the 17th century, was born at Plymouth in 1636, and bred at Oxford. He became a great admirer of Mr Baxter, and a zealous person for a commonwealth. After the Restoration, he published The Vanity of Dogmatizing; was chosen a fellow of the Royal Society; and, taking orders in 1662, was presented to the vicarage of Frome-Selwood in Somersetshire. The same year he published his *Lux Orientalis*: in 1665, his *Scepsis Scientifica*; and in the year following, Some Philosophical Considerations touching the being of Witches and Witchcraft, and other pieces on the same subject. In 1660, he published *Plus ultra*; or, The Progress and Advancement of Knowledge since the Days of Aristotle. He likewise published A seasonable Recommendation and Defence of Reason; and *Philosophia Pia*, or A Discourse of the Religious Temper and Tendencies of the Experimental Philosophy. In 1678 he was made a prebendary of Worcester, and died in 1680.

GLARIS, one of the cantons of Swisserland, is bounded on the east, partly by the Grisons, and partly by the territory of Sargans; on the north, by the bailiwick of Gaster, and by the lake Wahlestatt; on the east, by the canton of Schwits; and on the south, by part of the canton of Uri, and part of the league of the Grisons. It is a mountainous country, and contains about 20,000 inhabitants.

Glaris, Glasgow.

GLARIS, a town of Swisserland, capital of the canton of the same name, is seated in a plain, at the foot of high craggy mountains. The streets are large, and the houses kept in good repair. It has some public buildings; among which are two churches, one in the middle of the town, and the other without upon an eminence. In this eminence there is a cavern, with grotesque figures formed by the water that drops therein. The general assemblies of the country were formerly held on the first Sundays in May, where all the males above the age of sixteen were obliged to appear. Both the Calvinists and the Roman Catholics are tolerated in this town, and they have divine service by turns in the same church. It is seated on the river Lint, E. Long. 9. 13. N. Lat. 47. 6. Population about 2500.

GLASGOW, a large city of Lanerkshire or Clydesdale in Scotland, situated in W. Long. 4. 16. N. Lat. 55. 52.

Concerning the foundation of this city we have no authentic records. The word in the Gaelic language signifies a *gray smith*; from whence it has been inferred, that some spot in the most ancient part of the city was originally the residence of some blacksmith who had become eminent in his profession, so that the place went by his name.

1
Bishopric of Glasgow, when founded.

In the year 560, a bishopric is said to have been founded here by Saint Mungo, or Kentigern, supposed to be the son of Thamates, daughter of Loth king of the Picts; but in what state the town at that time was, is altogether uncertain. Most probably the priests and disciples who attended St Kentigern would contribute considerably towards its advancement; the aged and infirm, who were unfit for the purposes of war, or such as were religiously inclined, would come and settle round the habitation of the holy man, in order to have the benefit of his prayers; and as a number of miracles were said to have been wrought at his tomb, the same causes would still contribute to the increase of the town.

History has not informed us of the name of the prince who founded and endowed the bishopric of Glasgow in favour of St Kentigern. But from an abstract of the life of Kentigern (contained in Mr Innes's Critical Essay on the Ancient Inhabitants of Scotland), which was written in the 12th century, we learn, that the saint being ill used by Marken or Marcus, one of the kings of the Britons, retired into Wales. On the invitation of Roderic, however, one of Marken's successors, he returned to Glasgow, and enjoyed the see till 601, when he died. He was buried in the church of Glasgow, where his monument is still to be seen; and we find him marked among the saints in the Roman kalendar, January 13. 577.

The immediate successors of Kentigern were Baldrede and Conwal. The first established a religious house at Inchinnan; the second went into Lothian to preach to the Saxons; and both of them are ranked as saints in the Roman kalendar, Baldrede on the 6th of March

March 608, and Conwal on the 18th of May 612. From this time, however, till the 1115, we have no distinct accounts concerning the city or bishopric of Glasgow. We find then, that David I. king of Scotland made an attempt to retrieve the people from a state of gross barbarity into which they were fallen, and restored to the church those lands of which she had been robbed. The only account we have of the transactions with regard to Glasgow, during that period, is in the inquisition made by David concerning the church lands of Glasgow, and is as follows.—"This church, by the divine appointment, admitted St Kentigern into the bishopric, who furnished large draughts of knowledge to those thirsting after heavenly things, &c. But a fraudulent destroyer, employing his common wiles, brought in, after a long series of time, unaccountable scandals into the Cumbrian church. For after St Kentigern and many of his successors were removed to heaven, various disturbances everywhere arising, not only destroyed the church and her possessions, but, wasting the whole country, drove the inhabitants into exile. These good men being destroyed, various tribes of different nations flocking in from several quarters, possessed the foresaid deserted country; but being of different origins, and varying from each other in their language and customs, and not easily agreeing among themselves, they followed the manners of the Gentiles, rather than those of the true faith. The inhabitants of which unhappy and abandoned country, though living like brutes, the Lord, who chooses that none should perish, vouchsafed to visit in mercy," &c.

2
Barbarity of the people in the time of David I.

From the year 1116 to the Reformation, the records of the bishopric are tolerably complete. The most remarkable particulars furnished by them are the following.

In 1136, John Achaius, chosen bishop of Glasgow by David I. built and adorned a part of the cathedral, which he solemnly consecrated on the 9th of July. The king was present at the ceremony; and bestowed on the church the lands of Perdeyk, now Patrick. This prelate also divided the diocese into the two archdeanries of Glasgow and Teviotdale; and established the offices of dean, subdean, chancellor, treasurer, sacrist, chantor, and successor; and settled a prebendary upon each of them, out of the donatives he received from the king.

In 1174, Joceline, abbot of Melrose, was elected bishop, and consecrated by Eskilus, bishop of Lunden in Denmark, the pope's legate for that kingdom, on the 1st of June 1175. He rebuilt the cathedral, or rather made an addition to the church already built by John Achaius. He also procured a charter from William king of Scotland, erecting Glasgow into a royal borough, and likewise a charter for a fair to be held there annually for eight days.

3
Glasgow erected into a royal borough.

In 1335, John Lindsay, bishop of Glasgow, was killed in an engagement at sea with the English, as he was returning home from Flanders. His successor, William Rae, built the stone bridge over the Clyde. In the time of Matthew Glendoning, who was elected bishop in 1387, the great spire of the church, which had been built only of wood, was consumed by lightning. The bishop intented to have built another of stone: but was prevented by death, in 1408, from accomplishing his purpose. His successor, William Lauder, laid the foundation of the vestry of the cathedral, and built the great tower of stone as far as the first battlement. The great tower of the episcopal palace was founded about the year 1437, on which Bishop Cameron expended a great deal of money.

In 1447, William Turnbull, a son of the family of Bedrule in Roxburghshire, was chosen bishop. He obtained from King James II. in 1450, a charter erecting the town and the patrimony of the bishops into a regality. He also procured a bull from Pope Nicholas V. for erecting an university within the city, which he endowed, and on which he also bestowed many privileges. He died in 1454, leaving behind him a most excellent character. The establishment of the college contributed more than any thing that had been formerly done towards the enlargement of the town. Before this time the town seems to have been inconsiderable. Mr Gibson * is of opinion, that the number of its inhabitants did not exceed 1500. But though the establishment of the university greatly increased the number of inhabitants, it in fact destroyed the freedom of the town. Bishop Turnbull seems to have made a point of it with King James II. that the city of Glasgow, with the bishop's forest, should be erected into a regality in his favour; which was accordingly done at the time above mentioned; and this at once took away all power from the citizens, and transferred it to the bishop. As the powers of the bishop, however, were reckoned by Turnbull insufficient to convey to the members of the university all that freedom which he wished to bestow upon them, he therefore obtained from the king a great many privileges for them; and afterwards he himself, with the consent of his chapter, granted them many more.

4
Glasgow erected into a regality, and the university founded.

* Hist. of Glasgow, p. 74.

5
Which destroys the freedom of the city.

The good effects of the establishment of the college were very soon obvious in Glasgow. The number of inhabitants increased exceedingly; the high street, from the convent of the Black Friars, to where the cross is now placed, was very soon filled up; the ancient road which led to the common being too far distant for the conveniency of the new inhabitants, the Gallows-gate began to be built. Soon after, the collegiate church of the blessed Mary (now the Tron church) being founded by the citizens, occasioned the Trongate street to be carried to the westward as far as the church. The rest of the city increased gradually towards the bridge, by the building of the Saltmarket street. The borough roads, and the cattle that grazed on the commons, were now found insufficient to maintain the increased number of inhabitants; for which reason a greater degree of attention than formerly was paid to the fishing in the river. Many poor people subsisted themselves by this occupation; they were incorporated into a society; and in order that they might be at hand to prosecute their business, they built a considerable part of the street now called the *Bridge-gate*, but at that time *Fishers-gâte*.

6
Population of Glasgow increased by the university.

Notwithstanding all this, however, the city of Glasgow did not for a long time attain the rank among the other towns of Scotland which it holds at present. In 1556, it held only the 11th place among them, as appears by Queen Mary's taxation. The introduction of the reformed religion proved for some time prejudicial to the opulence of the city. The money which had

Glasgow.

had formerly been expended among the citizens by the bishop and his clergy, was now diverted into other channels: the advantages resulting from the university were also for a time lost; for as the reformers generally despised human learning, the college was in a manner deserted.

7
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the town
stroyed
a fire.

In the time of the civil wars, Glasgow suffered severely. To the mischief attending intestine discord, were added a pestilence and famine; and to complete their misfortunes, a violent fire broke out in June 1652, which destroyed the greatest part of the Saltmarket, Trongate, and High street. The fronts of the houses at that time were mostly of wood, so that they became an easy prey to the flames. The fire continued with great violence for the space of 18 hours; by which a great many of the inhabitants were ruined, the habitations of almost 1000 families being totally destroyed. On this account collections were made through different parts of the country; and to prevent such accidents for the future, the fronts were built with freestone, which abounds in the neighbourhood.

By the charter given to Bishop Turnbull in 1450, the citizens had been deprived of the power of electing their own magistrates, which was thenceforth exercised by the bishop; which, however, was not done without some resistance on the part of the inhabitants. After the Reformation was introduced into Scotland, we find this power exercised by the citizens, the bishop, the earl of Lennox, and others. The idea that the town was a bishop's borough, and not a royal free borough, gave occasion to this unsettled manner of appointing the magistracy; and though, in 1633, they were declared to be a royal free borough by the parliament, yet their freedom of election was afterwards disturbed by the privy council, by Cromwell, and the duke of York.

8
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But on the 4th of June 1690, the town was declared free by a charter of William and Mary; and in confirmation of this charter it was inserted in the act of parliament, dated June 14th the same year, that they should have power to elect their own magistrates as fully and freely, in all respects, as the city of Edinburgh or any other royal borough within the kingdom; which freedom of election still continues.

By the assessment of the boroughs in 1695, we find the city of Glasgow reckoned the second in Scotland in point of wealth, which place it still continues to hold.

9
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wealth.

To account for this great increase of wealth, we must observe, that for a long time, even before the restoration of Charles II. the inhabitants of Glasgow had been in possession of the sale of both raw and refined sugars for the greatest part of Scotland; they had a privilege of distilling spirits from their molasses, free of all duty and excise; the herring fishery was also carried on to what was at that time thought a very considerable extent; they were the only people in Scotland who made soap; and they sent annually some hides, linen, &c. to Bristol, from whence they brought back in exchange, a little tobacco, sugar, and goods, of the manufacture of England, with which they supplied a considerable part of the kingdom. From the year 1707, however, in which the union betwixt Scotland and England took place, we may date the prosperity of Glasgow. By the union, the American trade was laid open to the inhabitants: and so sensible were they of their advantageous situation, that they began almost instantly to prosecute that commerce; an assiduous application to which, ever since, hath greatly contributed to raise the city to the pitch of affluence and splendour which it at present enjoys. The city was now greatly enlarged; and as the community were sensible of the inconvenience that attended the want of a sufficient quantity of water in the river for carrying on their commerce, they resolved to have a port of their own nigher the mouth of the river. At first, they thought of making their harbour at Dumbarton: but as this is a royal borough, the magistrates opposed it; because they thought that the influx of sailors and others, occasioned by the harbour, would be so great, that a scarcity of provisions would be occasioned. The magistrates and town council of Glasgow, therefore, purchased some lands on the south side of the river Clyde for this purpose; and so expeditious were they in making their harbour, and rearing their town, that in 1710 a bailie was appointed for the government of Port-Glasgow. It is now a very considerable parish, and lies 21 miles nigher the mouth of Clyde than Glasgow.

10
Erection of
Port Glasgow.

In 1725, Mr Campbell, the member of parliament for Glasgow, having given his vote for having the malt tax extended over Scotland, a riot ensued among the lower class of people. In this disturbance, Mr Campbell's furniture was destroyed, and some excisemen were maltreated for attempting to take an account of the malt. General Wade, who commanded the forces in Scotland, had sent two companies of soldiers, under the command of Captain Bushel, to prevent any disturbance of this kind. Captain Bushel drew up his men in the street, where the multitude pelted them with stones. He first endeavoured to disperse the mob by firing with powder only: but this expedient failing, he ordered his men to load their pieces with ball; and, without the sanction of the civil authority, commanded them to fire four different ways at once. By this discharge about 20 persons were killed and wounded; which enraged the multitude to such a degree, that having procured some arms, they pursued Bushel and his men to the castle of Dumbarton, about 14 miles distant. General Wade being informed of this transaction, assembled a body of forces, and being accompanied by Duncan Forbes, lord advocate, took possession of the town: the magistrates were apprehended and carried prisoners to Edinburgh; but on an examination before the lords, their innocence clearly appeared, upon which they were immediately dismissed. Bushel was tried for murder, convicted, and condemned; but, instead of suffering the penalties of law, he was indulged with a pardon, and promoted in the service. Mr Campbell petitioned the house of commons for an indemnification of his losses: a bill was passed in his favour; and this, together with some other expences incurred in the affair, cost the town 9000l. sterling.

11
Disturbance about
the excise
bill.

During the time of the rebellion 1745, the citizens of Glasgow gave proof of their attachment to revolution principles, by raising two battalions of 600 men each, for the service of government. This piece of loyalty, however, had like to have cost them dear. The rebels, in their journey south, took a resolution to plunder and burn the city: which would probably have been done, had not Mr Cameron of Lochiel threatened, in that case, to withdraw his clan. A heavy contribution, however, was laid on. The city was com-

Glasgow.

pelled to pay 5000l. in money, and 500l. in goods; and on the return of the rebels from England, they were obliged to furnish them with 12,000 linen shirts, 6000 cloth coats, 6000 pairs of shoes, 6000 pairs of hose, and 6000 bonnets. These goods, with the money formerly paid them, the expence of raising and subsisting the two city battalions, and the charge of maintaining the rebel army in free quarters for ten days, cost the community about 14,000l. sterling; 10,000l. of which they recovered in 1749, by an application to parliament.

12 Change of manners and method of living.

About the year 1750, a very considerable change took place in the manner of living among the inhabitants of Glasgow. Till this time, an attentive industry, and a frugality bordering upon parsimony, had been their general characteristic; the severity of the ancient manners prevailed in its full vigour: But now, when an extensive commerce and increased manufactures had produced wealth, the ideas of the people were enlarged, and bolder schemes of trade and improvement were adopted; a new style was introduced in living, dress, building, and furniture; wheel carriages were set up, public places of entertainment were frequented, and an assembly-room, ball-room, and playhouse, were built by subscription; and from this time we may date all the improvements that have taken place, not only in Glasgow, but all over the west of

13 Acts of parliament in favour of the city.

Scotland. In 1753, an act passed for repairing several roads leading into the city of Glasgow. In 1756, an act for erecting and supporting a light-house in the island of Little Cumray, at the mouth of the Clyde, and for rendering the navigation of the frith and river more safe and commodious.—In 1759, an act for improving the navigation of the river Clyde to the city of Glasgow, and for building a new bridge across the river.—In 1767, the people of Glasgow having proposed to make a small cut or canal from the frith of Forth to that of Clyde, for the conveniency of their trade to the eastern side of the island, several gentlemen at Edinburgh, and throughout different parts of the kingdom, proposed that this canal should be executed upon a much larger scale than what had been originally projected. An act was accordingly obtained, and the canal executed in the manner described under the article CANAL.—In 1770, another act was obtained for improving the navigation of the river, building the bridge, &c. being an amendment of the former act for these purposes. In 1771, an act for making and widening a passage from the Saltmarket to St Andrew's church; for enlarging and completing the churchyard of that church, and likewise for building a convenient exchange or square in the city; also for amending and explaining the former act relative to the navigation of the Clyde. In 1783, the society known by the name of the chamber of commerce and manufactures was established. The object was to unite the influence of the merchants and manufacturers, and to establish a public fund to give greater efficacy to plans in which these classes might be interested. A royal charter was obtained constituting them a body politic, under the management of 30 directors. This chamber has since been of essential service, in promoting objects and undertakings connected with the advancement of trade. But the introduction of the cotton manufacture on a considerable scale, about 1786, made a greater change in the state of the trade of Glasgow than any event which had previously occurred, and formed indeed a new era in its history. From that time the progress of the town in commerce, population, and wealth, has been surprising.

14 Description of the city.

The most ancient part of the city stands on a rising ground. The foundation of the cathedral is 104 feet higher than the bed of the river; and the descent from the high ground reaches to about 100 yards below the college. The rest of the city is built chiefly upon a plain, bounded southward by the Clyde, and northward by a gentle ridge of hills lying in a parallel direction with that river. These grounds, till lately, consisted of gardens and fields; but are now covered with buildings, in consequence of the increasing wealth and population of the city. The streets are all clean and well paved; and several of them intersecting one another at right angles, produce a very agreeable effect. The four principal streets, crossing one another in that manner, divide the city nearly into four equal parts; and the different views of them from the cross, or centre of intersection, have an air of great magnificence. The houses, consisting of four or five floors in height, are built of hewn stone, generally in very good taste, and many of them elegant. The most remarkable public buildings are,

15 Of the cathedral.

1. *The Cathedral*, or *High Church*, is a magnificent building, and its situation greatly to its advantage, as it stands higher than any part of the city. It has been intended to form a cross, though the transverse part has never been finished. The great tower is founded upon four large massy pillars, each of them about 30 feet in circumference. The tower itself is $25\frac{1}{2}$ feet square within; and is surrounded by a balustrade, within which rises an octangular spire terminated by a vane. The tower upon the west end is upon the same level, but appears not to have been finished, though it is covered over with lead. In this tower is a very large bell 11 feet four inches in diameter. The principal entry was from the west; the gate 11 feet broad at the base, and 17 feet in height. The west end of the choir is now appropriated for a place of divine worship; and is divided from the remaining part by a stone partition, which is enclosed by another stone wall parting it from the nave. It is impossible to form an adequate idea of the awful solemnity of the place occasioned by the loftiness of the roof and the range of pillars by which the whole is supported.

The nave of the church rises four steps higher than the choir; and on the west side stood the organ loft, formerly ornamented with a variety of figures, but now defaced. The pillars here are done in a better taste than those in the choir, and their capitals are ornamented with fruits. The arched roof of the altar is supported by five pillars, over which was a fine terrace walk, and above it a large window of curious workmanship, but now shut up. On the north side of the altar is the vestry, being a cube of 28 feet, the roof arched and vaulted at top, and supported by one pillar in the centre of the house. Arched pillars from every angle terminate in the grand pillar, which is 19 feet high. The lower part of the south cross is made use of as a burying place for the clergy of the city; and is by much the finest piece of workmanship in the whole building. It is 55 feet long, 28 broad, and

Glasgow. 15 high; arched and vaulted at top, and supported by a middle range of pillars, with their capitals highly ornamented; corresponding to which are columns adjoining to the walls, which, as they rise, spring into semi-arches, and are everywhere met at acute angles by their opposites, and are ornamented with carvings at the closing and crossing of the lines. At the east end of the choir you descend by flights of steps upon each side into passages which, in former times, were the principal entries to the burying vault, which is immediately under the nave. It is now made use of as a parish church for the barony of Glasgow; and is full of pillars, some of them very massy, which support the arched roof: but it is a very uncomfortable place for devotion. The space under the altar and vestry, though now made use of as a burying place by the heritors of the barony, was formerly, according to tradition, employed for keeping of the relicks; and indeed, from the beautiful manner in which this place is finished, one would imagine that it had not been destined for common use. Here is shown the monument of St Mungo, or Kentigern, with his figure lying in a cumbent posture.

The whole length of the cathedral within the walls is 284 feet, its breadth 65; the height of the choir, from the floor to the canopy, 90 feet; the height of the nave, 85 feet; the height of the middle tower, 220 feet. This fabric was begun by John Achaius in 1123, and consecrated in 1136: and continued by succeeding bishops till such time as it was finished in the manner in which it stands at present. The wealth of the see of Glasgow, however, was not sufficient for so great an undertaking, so that they were obliged to have recourse to all the churches of Scotland for assistance in it.

This venerable edifice was in danger of falling a victim to the frenzy of fanaticism in 1579; and owed its preservation to the spirit and good sense of the tradesmen, who, upon hearing the beat of drum for collecting the workmen appointed to demolish it, flew to arms, and declared that the first man who pulled down a single stone should that moment be buried under it.

Near the cathedral are the ruins of the bishop's palace or castle, enclosed with a wall of hewn stone by Archbishop James Beaton; the great tower built by Archbishop Cameron in 1426.

16 St Andrew's church. 2. *St Andrew's Church* was begun by the community in 1739, and finished in 1756. It is the finest piece of modern architecture in the city; and is built after the model of St Martin's in the Fields, London, whose architect was the famous Gibbs. The length of the church is 104 feet, and its breadth 66. It has a fine arched roof, well ornamented with figures in stucco, and sustained by stone columns of the Corinthian order. Correspondent to the model, it has a place for the altar on the east, in which is a very ancient Venetian window; but the altar place being seated, makes this end appear to no great advantage. The fronts of the galleries and the pulpit are done in mahogany in a very elegant manner. The spire by no means corresponds with the rest of the building; and, instead of being an ornament, disgraces this beautiful fabric. Its height is 170 feet.

Besides the cathedral (which contains three congregations) and St Andrew's church, there is a number of others, as the College church, Ram's-horn, Tron, St Enoch's and St George's; together with an English chapel, Highland church, several seceding meeting-houses, and others for sectaries of various denominations.

3. *The College.*—The front of this building extends along the east side of the High street, and is upwards of 330 feet long. The gate at the entrance is decorated with rustics, and over it are the king's arms. The building consists of two principal courts or squares. The first is 88 feet long and 44 broad. The west side is elevated upon stone pillars, on which are placed pilasters supporting the Doric entablature, and ornamented with arches forming a piazza. Above these is the public hall; the ascent to which is by a double flight of steps enclosed by a handsome stone balustrade, upon the right of which is placed a lion, and on the left an unicorn, cut in freestone. The spire stands on the east side, is 135 feet high, and has a very good clock. Under this is the gateway into the inner and largest court, which is 103 feet long and 79 broad. Over the entry, in a niche, is a statue of Mr Zacharias Boyd, who was a benefactor to the university. On the east side of the court is a narrow passage leading into a handsome terrace walk, gravelled, 122 feet long by 64 feet broad. This walk is enclosed to the east by an iron palisade, in the centre of which is a gate leading into the garden. This last consists of seven acres of ground, laid out in walks for the recreation of the students; and there is also a botanic garden. On the south side of the walk stands the library; a very neat edifice, well constructed for the purpose intended, and containing a very valuable collection of books. Underneath are preserved in cases all the Roman inscriptions found on Graham's Dike, together with altars and other antiquities collected from different parts of Scotland.—Adjoining there is an observatory, well furnished with astronomical instruments. The college also possesses, by bequest, the late Dr Hunter's famous anatomical preparations, library, and museum. A beautiful building was erected in 1806 for its reception. 17 The college.

4. *New Jail.*—The old jail having become much too small in consequence of the rapid growth of the town, a new one was projected in 1808. As the Glasgow jail receives prisoners from the neighbouring counties, application was made first to them, and afterwards to government for assistance in defraying the expence, but without effect. In consequence of this the plan was reduced, and the expence, amounting to 34,800l. was defrayed from the funds of the burgh. The new jail was opened in 1814, and is admitted to be one of the most commodious and best arranged in the country. It is situated at the west end of the Green, in a healthy and well aired position; and besides a court house capable of containing 500 persons, and several other public offices, it contains 122 apartments for prisoners, sixteen large galleries for air and exercise, and two paved court yards, 69 feet by 46. The jail is formed into sixteen distinct allotments—eight for debtors, and eight for criminals. The building is amply supplied with pure water, and is carefully cleaned. There are four well aired infirmary rooms, and a chapel which holds 200 persons. During the year ending 1st April 1819, no less than 1809 persons had been incarcerated;—683 debtors and 1126 delinquents. 18 New jail.

19 Bridewell. 5. *Bridewell.*—Till the year 1798 there was no regular Bridewell in Glasgow. The present Bridewell which is in Duke street, is six stories high, and contains a chapel, a work-room, and 105 cells, each eight feet by seven, with a public kitchen, apartments for the keeper, and several work-rooms. It has now, however, become too small for the city; and a scheme is at present in contemplation for erecting another on a more extensive scale, and a better plan.

20 Guild hall. 6. *The Guild Hall* or *Merchants House.* This building is situated upon the south side of Bridgegate street; and is in length 82 feet, in breadth 31. The great hall, which is the whole length and breadth of the building, is so capacious, that it is better adapted for the reception of great and numerous assemblies than any other in the city. This house is adorned with a very elegant spire 200 feet high.

21 Town's hospital. 7. *The Town's Hospital* is a very neat building, consisting of two wings and a large front; the length 156 feet, the breadth of the centre 30 feet, and the depth of the wings 68 feet. Behind the building is an infirmary 127 feet long by 25 feet broad, the ascent to which is by a flight of steps. The lower part of this building is appointed for the reception of lunatics. The area between the buildings is large, which, with the agreeable open situation of the hospital on the river, must conduce to the health of the inhabitants.

22 Grammar school. 8. *The Grammar School* is situated in the new part of the town, to the north-west, and was built in 1787. It is a very handsome building, containing a large hall, and six airy commodious teaching rooms. In this school there are four classes, the course being four years: each class is carried on the whole five years by the same master; so that, there being no rector, each master is head of the school one year in rotation. It is under the direction of a committee of the town council; who, assisted by the professors, clergy, and other persons of learning, frequently visit it during the session; and at an annual examination, prizes are distributed to the scholars according to their respective merits. The number of scholars is about 540. It is found that there are 10,200 persons educated in Glasgow who pay fees, besides 1100 educated at free or charity schools.

23 Bridges. 9. *Bridges.*—There are at Glasgow two stone bridges over the Clyde, and a wooden one. The *Old Bridge* at the foot of Stockwell street, was built by Bishop Rae in 1345. Ten feet were added to its breadth in 1777, and its present dimensions are, 415 feet in length, and 22 in breadth. The *New Bridge* is built in an elegant manner. It is 32 feet wide, with a commodious footway for passengers, five feet broad on each side, raised above the road made for carriages, and paved with freestone. This bridge is about 500 feet in length, and consists of seven arches, the faces of which are wrought in rustic, with a strong block cornice above. The arches spring but a little way above low water mark; which, though it renders the bridge stronger than if they sprung from taller piers, diminishes its beauty. This bridge was begun in 1768, and finished in 1772.

24 Markets, &c. 10. *The Markets in King's Street* are justly admired, as being the completest of their kind in Britain. They are placed on both sides of the street. That on the east side, appropriated entirely for butcher meat, is 112 feet in length, and 67 in breadth. In the centre is a spacious gateway, decorated on each side with coupled Ionic columns, set upon their pedestals, and supporting an angular pediment. At the north end is a very neat hall belonging to the incorporation of butchers, the front ornamented with rustics and a pediment. The markets upon the west side of the street consist of three courts, set apart for fish, mutton, and cheese. The whole of the front is 173 feet, the breadth 46 feet; in the centre of which, as on the opposite side, is a very spacious gateway of the Doric order, supporting a pediment. This is the entry to the mutton market. Each of the other two has a well proportioned arch faced with rustics for the entrance. All these markets are well paved with freestone, have walks all round them, and are covered over for shelter by roofs standing upon stone piers, under which the different commodities are exposed to sale. They have likewise pump wells within, for cleansing away all the filth; which render the markets always sweet and agreeable. These markets were erected in 1754.

11. *The Market for Vegetables* is neat and commodious; and the principal entry is decorated with columns. It is situated in the Candleriggs, and is laid out in the same manner with the markets in King's street.

12. *The Guard House* is a very handsome building, with a piazza formed by arches, and columns of the Ionic order set upon their pedestals. It was originally situated on the High street, at the corner of the Candleriggs street: but was afterwards carried near half way up the Candleriggs, where it occupies the ground on which the weigh-house formerly stood, and is made larger and more commodious than it was before. An excellent new weigh-house has been erected at the head of the Candleriggs: and at the foot of the Candleriggs, or corner next the High street, where the guard-house was formerly situated, a superb new hotel has been built, containing 75 fire rooms. 25 Guard house.

The most remarkable public charities in Glasgow are,

1. *Muirhead's* or *St Nicholas's Hospital.* This was originally appointed to subsist 12 old men and a chaplain; but its revenues have, from some unknown causes, been lost; so that no more of them now remains than the paltry sum of 139l. 2s. 5d. Scots money, 128l. of which is annually divided among four old men, at the rate of 2l. 13s. 4d. sterling each. 26 Public charities.

2. *Hutcheson's Hospital*, was founded and endowed in 1639 by George Hutcheson of Lamb-hill, notary public, and Mr Thomas Hutcheson his brother, who was bred a preacher, for the maintenance of old men and orphans. The funds of this hospital were increased by James Blair, merchant in Glasgow in 1710, and by subsequent donations. The income, which is now large, is distributed in pensions to old people from 3l. to 20l. and in educating about 70 children. The sum distributed in pensions in 1819 was 1790l. 7s.

3. *The Merchants House* likewise distributes in pensions and other charities about 800l. yearly.

4. *The Town's Hospital*, above described, was opened for the reception of the poor on the 15th of November 1733. The funds whence this hospital is subsisted are, the general session, the town council, the trades house,

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house, and merchants house, the interest of money belonging to their funds, which are sums that have been mortified for the use of the house. These supplies, however, are fonnd insufficient to defray the expences of the house; for which reason an assessment is annually made upon the inhabitants in the following manner. The magistrates nominate 12, 14, or sometimes more gentlemen of known integrity and character, who have a list laid before them of all the inhabitants in town. This list they divide into 16 or 18 columns, Each of these columns contains the names of such inhabitants as carry on trade to a certain extent, or are supposed to be well able to pay the sum affixed to the particular column in which their names are inserted. If it is necessary to raise 500l. for instance, then each name, in every separate column, is valued at as much as the fortunes of the persons in each particular column are supposed to be. If 1000l. or more is to be raised, it is only continuing a proportional increase through the whole of the columns. This assessment has been gradually increasing. In 1782 it was 1057l.; in 1800 it was 4534l., and in 1819 it was 10,303l. The rate of assessment has also increased during the war from 1 to 3 shillings on 100l. of property.

5. *Wilson's Charity* for the education of boys, was founded by George Wilson, who in 1778 left 3000l. for that purpose. This fund is now considerably increased, and gives education and clothing to 48 boys, who each continues four years, so that 12 are admitted annually.

Besides these, there are many public schools for the education of children; as well as many institutions of private societies for the purpose of relieving the indigent and instructing youth, such as *Graham's Society*, *Buchanan's Society*, the *Highland Society*, &c. These last put annually 20 boys apprentices to trades, and during the first three years give them clothing and education.

27 Members of the university.

The university of Glasgow owes its origin, as we have already observed, to Bishop Turnbull. The institution consisted at first of a rector, a dean of faculty, a principal who taught theology, and three professors of philosophy; and, soon after this, the civil and canon laws were taught by some clergymen. From the time of its establishment in 1450 to the Reformation in 1560, the college was chiefly frequented by those who were intended for the church; its members were all ecclesiastics, and its principal support was derived from the church. The Reformation brought the university to the verge of destruction: masters, students, and servants, all forsook it. The magistrates were so sensible of the loss which the community had sustained by this desertion, that they endeavoured to restore it in 1572, by bestowing upon it considerable funds, and prescribing a set of regulations for its management. These, however, proved insufficient; for which reason King James VI. erected it anew, by a charter called the *Nova Erectio*, 1577, and bestowed upon it the teinds of the parish of Govan. The persons who were to compose the new university were, a principal, three professors of philosophy, four students bursars, one œconomus, a principal's servant, a janitor, and cook.

Since the year 1577, the funds of the university have been considerably increased by the bounty of kings and the donations of private persons. The professors have therefore also been increased: so that at present the university of Glasgow consists of a chancellor, rector, dean of faculty, principal, and 14 professors (six of them in the gift of the crown), together with bursars, &c. The archbishop of Glasgow was formerly chancellor of the university *ex officio;* at present, the chancellor is chosen by the rector, dean of faculty, principal, and masters.

The chancellor, as being the head of the university, is the fountain of honour, and in his name are all academical degrees bestowed. The office of rector is to exercise that academical jurisdiction in disputes among the students themselves, or between the students and citizens, which is bestowed upon the greater part of the universities in Europe. He is chosen annually in the *comitia;* that is, in a meeting in which all the students, as well as the other members of the university, have a voice. Immediately after his admission, he has been in use to choose certain persons as his assessors; and counsellors in his capacity of judge; and, in former periods, it was customary to name the ministers of Glasgow, or any other gentlemen who had no connexion with the university; but, for a great while past, the rector has constantly named the dean of faculty, the principal, and masters, for his assessors; and he has always been, and still is, in the daily practice of judging in the causes belonging to him, with the advice of his assessors. Besides these powers as judge, the rector summons and presides in the meetings of the university for the election of his successor; and he is likewise in use to call meetings of the professors for drawing up addresses to the king, electing a member to the general assembly, and other business of the like kind.

The dean of faculty has, for his province, the giving direction with regard to the course of studies; the judging, together with the rector, principal, and professors, of the qualifications of those who desire to be created masters of arts, doctors of divinity, &c.; and he presides in meetings which are called by him for these purposes. He is chosen annually by the rector, principal, and masters.

The principal and masters, independent of the rector and dean, compose a meeting in which the principal presides; and as they are the persons for whose behoof chiefly the revenue of the college was established, the administration of that revenue is therefore committed to them. The revenue arises from the teinds of the parish of Govan, granted by King James VI. in 1557; from the teinds of the parishes of Renfrew and Kilbride, granted by the same monarch in 1617, and confirmed by King Charles I. on the 28th of June 1630; from the teinds of the parishes of Calder, Old and New Monkland, conveyed to them by a charter from Charles II. in 1670; from a tack of the archbishopric; and from several donations conferred by private persons.

The college of Glasgow, for a very considerable time after its erection, followed the mode of public teaching which is common even to this day in Oxford and Cambridge, and in many other universities throughout Europe; that is, each professor gave a few lectures every year, *gratis*, upon the particular science which he professed: but in place of this, the professors have, for a great while past, adopted the mode of private teaching: that is, they lecture and examine two hours every day during the session, viz. from the 10th of October to the 10th of June; a method which comes much cheaper to the student, as he has it in his power, if he is attentive, to acquire his education without being under the necessity of employing a tutor. They have also private classes, in which they teach one hour per day. The number of students who attended this college at the various classes in the session 1819-1820, was no less than 1264.

28
History of Glasgow.

The trade of Glasgow is said to have been first promoted by one Mr William Elphinstone in 1420. This trade was most probably the curing and exporting of salmon; but the first authentic document concerning Glasgow as a trading city is in 1546. Complaints having been made by Henry VIII. king of England, that several English ships had been taken and robbed by vessels belonging to Scotland, an order of council was issued, discharging such captures for the future; and among other places made mention of in this order is the city of Glasgow. The trade which at that time they carried on could not be great. It probably consisted of a few small vessels to France loaded with pickled salmon; as this fishery was, even then, carried on to a considerable extent, by Glasgow, Renfrew, and Dumbarton. Between the years 1630 and 1660, a very great degree of attention seems to have been paid to inland commerce by the inhabitants of Glasgow. Principal Baillie informs us, that the increase of Glasgow arising from this commerce was exceedingly great. The exportation of salmon and of herrings was also continued and increased. In the war between Britain and Holland during the reign of Charles II. a privateer was fitted out in Clyde to cruise against the Dutch. She was called the *Lion of Glasgow*, Robert M'Allan commander; and carried five pieces of cannon, and 60 hands.

A spirit of commerce appears to have arisen among the inhabitants of Glasgow between the years 1660 and 1707. The citizens who distinguished themselves most during this period were Walter Gibson and John Anderson. Gibson cured and packed in one year 300 lasts of herrings, which he sent to St Martin's in France on board of a Dutch vessel called the *St Agate* of 450 tons burden; his returns were brandy and salt. He was the first who imported iron from Stockholm into Clyde. Anderson is said to have been the first who imported white wines.

Whatever their trade was at this time, it could not be considerable: the ports to which they were obliged to trade lay all to the eastward: the circumnavigation of the island would therefore prove an almost unsurmountable bar to the commerce of Glasgow; and of consequence the people on the east coast would be possessed of almost all the commerce of Scotland. The union with England opened a field for commerce for which the situation of Glasgow, so convenient in respect to the Atlantic, was highly advantageous. Since that time the commerce of the east coast was declined, and that of the west increased to an amazing degree. No sooner was the treaty of union signed, than the inhabitants of Glasgow began to prosecute the trade to Virginia and Maryland; they chartered vessels from Whitehaven, sent out cargoes of goods, and brought back tobacco in return. The method in which they at first proceeded in this trade was certainly a very prudent one. A supercargo went out with every vessel. He bartered his goods for tobacco, until such time as he had either sold off his goods, or procured as much tobacco as was sufficient to load his vessel. He then immediately set out on his return; and if any of his goods remained unsold, he brought them home with him. While they continued to trade in this way, they were of great advantage to the country, by the quantity of manufactures which they exported; their own wealth began to increase; they purchased ships of their own; and, 1718, the first vessel of the property of Glasgow crossed the Atlantic. Their imports of tobacco were now considerable, and Glasgow began to be looked upon as a considerable port: the tobacco made at the ports of Bristol, Liverpool, and Whitehaven, was observed to dwindle away; the people of Glasgow began to send tobacco to these places, and to undersell the English even in their own ports. Thus the jealousy of the latter was soon excited, and they took every method in their power to destroy the trade of Glasgow. The people of Bristol presented remonstrances to the commissioners of the customs at London against the trade of Glasgow, in 1717. To these remonstrances the merchants of Glasgow sent such answers to the commissioners, as convinced them that the complaints of the Bristol merchants were without foundation. But in 1721, a most formidable confederacy was entered into by almost all the tobacco merchants in South Britain against the trade of Glasgow. Those of London, Liverpool, and Whitehaven, presented severally to the lords of the treasury, petitions, arraigning the Glasgow merchants of frauds in the tobacco trade. To these petitions the Glasgow people gave in replies; and the lords of the treasury, after a full and impartial hearing, were pleased to dismiss the cause with the following sentence: "That the complaints of the merchants of London, Liverpool, and Whitehaven, were groundless; and that they proceeded from a spirit of envy, and not from a regard to the interest of trade, or of the king's revenue."

But the efforts of these gentleman did not stop here. They brought their complaints into the house of commons. Commissioners were sent to Glasgow in 1722, who gave in their reports to the house in 1723. The merchants sent up distinct and explicit answers to these reports; but such was the interest of their adversaries, that these answers were disregarded. New officers were appointed at the ports of Greenock and Port Glasgow, whose private instructions seem to have been to ruin the trade if possible by putting all imaginable hardships upon it. Hence it languished till the year 1737; but after that time it began to revive, though even after its revival it was carried on but slowly for a considerable space of time.

At last, however, the active and enterprising spirit of the merchants, seconding the natural advantages of their situation, prevailed over all opposition; and the American trade continued to flourish and increase until the year 1775, insomuch that the importation of tobacco into Clyde that year from the provinces of Virginia, Maryland, and Carolina, amounted to 57,143 hogsheads. But since the breach with America, this trade has now greatly fallen off, and very large sums are said to remain due to the merchants from that quarter of the world.

29 With regard to the manufactures of Glasgow, Mr Gibson is of opinion that the commerce to America first suggested the idea of introducing them, in any considerable degree at least. The first attempts in this way were about the year 1725, and their increase for some time was very slow, nor did they begin to be considerable till great encouragement was given by the legislature to the linen manufacture in Scotland. The first causes of the success of this manufacture were the act of parliament in 1748, whereby the wearing of French cambrics was prohibited under severe penalties; that of 1751, allowing weavers in flax or hemp to settle and exercise their trades anywhere in Scotland free from all corporation dues; and the bounty of three halfpence per yard on all linens exported at and under 18d. per yard. Since that time a spirit of manufacture has been excited among the inhabitants of Glasgow; and great variety of goods, and in very great quantity, have been manufactured. Checks, linen, and linen and cotton, are manufactured to a great extent. Printed linens and cottons were begun to be manufactured in 1738; but they only made garments till 1754, when handkerchiefs were first printed.

Manufactures of Glasgow.

Besides these, a great variety of articles are manufactured at Glasgow, of which our limits will not permit us to enter into a detail, such as soap, refining of sugar, ironmongery, brass, jewellery, glass both common and white, pottery, &c. Types for printing are made in this city by Dr Wilson and Sons, equal, if not superior, in beauty to any others in Britain. Printing of books was first begun here by George Anderson about the year 1638. But there was no good printing in Glasgow till the year 1735, when Robert Urie printed several books in a very elegant manner. The highest perfection, however, to which printing hath yet been carried in this place, or perhaps in any other, was by the late Robert and Andrew Foulis, (who began in the year 1740); as the many correct and splendid editions of books printed by them in different languages sufficiently testify. Some of their classics, it is said, are held in such high esteem abroad, as to sell nearly at the price of ancient MSS. The same gentlemen also established an academy of painting; but the wealth of Scotland being unequal to the undertaking, it has been since given up.

The inventions and improvements introduced into the cotton manufacture by Hargreaves, Arkwright, and others, gave a new impulse to this species of industry. The people of Glasgow now found the manufacture of these articles very profitable, and about 1786 had begun to abandon the manufacture of cambrics, lawns, gauzes, and other light fabrics of linen, which had grown up there in the course of the century; and before 1792 the former of these manufactures had almost entirely superseded the latter. About 1782, the annual value of the whole manufactures of Glasgow did not exceed 800,000l. and in 1818 it was estimated that 105,000,000 yards of cotton cloth were manufactured at Glasgow, valued at 5,200,000l. In the spinning department there were in 1819 fifty-four mills employed, containing nearly 600,000 spindles; and the capital invested in buildings and machinery for carrying on this branch is estimated 1,000,000l. For weaving this yarn there are 2800 looms moved by mechanical power, producing weekly about 8400 pieces of cloth; and there are, as nearly as can be ascertained, 32,000 hand looms.

One of the late improvements most deserving of attention is the construction of steam boats. Glasgow was the first town in Britain to adopt this improvement, and it is now the centre of a greater amount of steam boat navigation than any other town in the island. These vessels were introduced by Mr Henry Bell, an ingenious self-taught engineer in 1812; and in 1819 there were no less than 28 of them plying on the Clyde, and sailing some of them as far as Liverpool. The passage between Glasgow and Greenock, which is 26 miles, is usually performed in three hours. So much has this new invention increased the intercourse between these two places, that previous to its introduction it is calculated that not more than fifty persons passed and repassed in a day, whereas now the number is seldom less than four or five hundred.

Besides various improvements in the old streets, several handsome new ones as well as new squares have been added. The site of these new buildings is the tract of rising ground already mentioned as the north boundary of the town previous to its late extension. The western part of it, which is perfectly level, is occupied by a spacious square, denominated *George's Square*. The grass plot in the middle is enclosed with a handsome iron railing. The square is deficient in regularity; the houses on the west side being a story higher than those of the east; but in other respects it is very neat. Farther west a variety of new streets have been built, all of which are in a neat, and many in a very elegant style of architecture. St George's church, a simple but elegant structure, with a very handsome tower, was opened in 1807. St John's church, which is considerably larger, was opened in 1819. The Roman Catholic chapel, erected a few years ago, is admired as a good specimen of the Gothic style. The New Theatre in Queen street, which was opened in 1804, is a handsome edifice, and cost 18,500l. Among the objects of a purely ornamental nature lately erected, may be mentioned the brass statue of Sir John Moore, placed at the south side of George's square, and the stone obelisk in honour of Lord Nelson, which stands in the Green.

On the same or south side of the town, westward, is the Broomielaw, where the quay is situated. Till within these few years, the river here, and for several miles distance, was so shallow and so obstructed by shoals, as to admit only of small craft from Greenock, Port Glasgow, and the Highlands; but of late it has been cleared and deepened so as to admit vessels of considerable burden; and it is intended to make the depth as nearly equal as possible to that of the canal, in order that the vessels from Ireland and the west coast may come up Clyde and unload at the Broomielaw.

The government of the city of Glasgow is vested in a provost and three bailies, a dean of guild, deacon convener, and a treasurer, with a common council of 13 merchants and 12 mechanics. The provost and two of the bailies must, by the set of the borough, be elected from the merchant rank, and the other bailie from 30

30 Government, revenue, &c. of the city.

Glasgow.

from the trades rank, i. e. the mechanics. The provost is, from courtesy and custom, styled *lord provost*. He is properly lord of the police of the city, president of the community, and is *ex officio* a justice of the peace for both the borough and county.

Many of the inhabitants of Glasgow were convinced of the necessity of a new system of police, a number of years before the sanction of parliament was obtained for that purpose, which was granted in the year 1800. The act vested the management of the police in the lord provost, bailies, dean of guild, deacon convener, and 24 commissioners, one being chosen out of each ward into which the city is divided. The object of the bill was to procure an extension of the royalty, to pave, light, and clean the streets, for regulating the police, and nominating officers and watchmen, appointing commissioners, raising funds, and granting certain powers to the magistrates and council, town and dean of guild courts, and for several other purposes.

In framing this system of police, it was wisely provided that the commissioners shall not enjoy the office for life; nor even for a long period, but upon the supposition of being re-elected, and that every person properly qualified may have a chance for the office, and by consequence be entitled to a voice in the management of the funds and the establishment.

In order to raise funds for defraying the expence of the police establishment, the lord provost, magistrates and commissioners, on the first Monday of September, annually assess all occupiers, renters, or possessors of dwelling houses, cellars, shops, warehouses, and other buildings within the royalty, in proportion to the rent. The act expired in 1807, and was then renewed for 14 years longer. The rates of assessment fixed by the second, are as follows:—

On the yearly rent of subjects valued		
At 4l. and under 6l. sterling annually,	5d.	per pound.
At 6l. and under 10l.	$7\frac{1}{2}$d.	do.
At 10l. and under 15l.	$11\frac{1}{4}$d.	do.
At 15l. and upwards,	1s. 3d.	do.

The rates actually levied however under the police act have generally been under this amount. In 1817–18 it was 4d. 6d. 9d. and 1s. The disbursements for lighting, watching, and cleaning, during the same year, amounted to 11,617l. The establishment consisted of 20 officers, 80 watchmen, 20 patrole, and 16 scavengers. The number of lamps was 1472. In 1819 about two-thirds of the lamps were lighted with gas. The officers have power to bring to justice persons guilty of street robberies, house-breakings, assaults, thefts, shop-lifting, picking pockets, frequenters of disorderly houses; to suppress mobs and riots; to assist in extinguishing fires, in guarding and watching the streets, and in assisting the magistrates in every thing which relates to the police, peace, and good order of the city. These officers have hitherto given general satisfaction in the discharge of their duty, by seeing that the streets are kept clean, well lighted and guarded. In a word, property and personal safety are well secured.

Many whole and elegant streets have of late years been added to it, so that its rapid extension, increasing population, and flourishing commerce, justly entitle it to rank with any city in Scotland, or perhaps in the British empire.

Glasgow.

The revenue of the town arises from a duty upon all grain and meal brought into the city (which tax is denominated *the ladles*); from the rents of lands and houses the property of the community; from an impost of two pennies Scots upon every Scots pint of ale or beer brewed, inbrought, or sold within the city; from certain duties payable out of the markets; from the rents of the seats in churches; from the duties of cranage at the quay, at the weigh-house, &c. As to the tonnage on the river, the pontage of the bridge, and statute work; these, making no part of the city revenue, are kept separate and distinct under the management of commissioners appointed by act of parliament.

31 Number of inhabitants.

About the time of the Union, the number of inhabitants in Glasgow was reckoned about 14,000. In 1765, when a new division of the parishes took place, they were estimated at 28,000. In 1785, when an accurate survey was made, the number was 45,889, including the inhabitants of the suburbs, the Calton, Gorbals, and Anderston. Since that time, the new buildings, as above noticed, have been erected, and the city has become greatly more populous. In 1791 the number of inhabitants was found to be 66,578. In 1811 they amounted to 110,460, and in 1820 to 147,197. Glasgow is therefore at present indisputably the second city in Britain for population. The rental of shops and houses in 1773 was 36,706l. and in 1820 it had increased to 286,340l.

The climate of Glasgow, similar to that of most other parts of the island, is variable; but there are some circumstances peculiar to its local situation which tend to affect it more than that of some other places nearer the middle of the country. That part of the country in which Glasgow is situated, is almost in the narrowest part of the isthmus betwixt the Forth and Clyde, from which position the air is frequently refreshed by temperate breezes from the sea. The wind is south-west and west for nearly two-thirds of the year, and is saturated with vapour in its passage across the Atlantic; and the sky being frequently clouded with it, the heats of summer are not so intense as in some other places. Fogs are not so common as in the neighbourhood of Edinburgh, and severe frosts are seldom of long continuance, nor are snows either very deep, nor do they lie long. Thunder and lightning are rare about Glasgow, and seldom destructive.

The soil in the vicinity is partly a rich clay and partly a light sand. The grain raised about the city is not sufficient for the consumpt of the inhabitants, but vast quantities are brought from Ireland, Ayrshire, and the east country. While digging the foundation for the Tontine buildings in the midst of the city, a piece of a boat was found several feet below the surface of the ground, imbedded in sand and gravel, from which it would appear that the channel of the river had once run in that direction. In August 1801, while repairing a division of the cathedral, below the pavement opposite the pulpit, about two feet deep, part of a human skeleton was found, and a gold chain about 30 inches long lying above the bones of the leg. The date on the stone was 1599, but the inscription in the Saxon character was wholly effaced.

The

Glasgow, Glass.

The general character of the people is that of industry and attention to business, by which many of them have arisen to a state of independence. They were formerly said to be remarkable for severity and apparent sanctity of manners; but at present they are not more distinguished in this respect than any of their neighbours. The crimes of robbery and house-breaking have, of course, increased with the increase of population; but many of these may be fairly charged upon strangers, and it would be uncandid on that account to attach blame to the inhabitants at large. See GLASGOW, SUPPLEMENT.

GLASS, a transparent, brittle, factitious body, produced from sand melted in a strong fire with fixed alkaline salts, lead, slags, &c. till the whole becomes perfectly clear and fine. The word is formed of the Latin *glastum*, a plant called by the Greeks *isatis*, by the Romans *vitrum*, by the ancient Britons *guadum*, and by the English *woad*. We find frequent mention of this plant in ancient writers, particularly Cæsar, Vitruvius, Pliny, &c. who relate that the ancient Britons painted or dyed their bodies with glastum, guadum, vitrum, &c. i. e. with the blue colour procured from this plant. And hence the factitious matter we are speaking of came to be called *glass;* as having always somewhat of this bluishness in it.

I History of glass-making.

At what time the art of glass-making was first invented, is altogether uncertain. Some imagine it to have been invented before the flood: but of this we have no direct proof, though there is no improbability in the supposition; for we know, that it is almost impossible to excite a very violent fire, such as is necessary in metallurgic operations, without vitrifying part of the bricks or stones wherewith the furnace is built. This indeed might furnish the first hints of glass-making; though it is also very probable, that such imperfect vitrifications would be observed a long time before people thought of making any use of them.

Neri traces the antiquity of glass as far back as the time of Job. That writer, speaking of the value of wisdom (chap. xxviii. verse 17.), says, that gold and *crystal* cannot equal it. But this word, which Neri will have to signify factitious glass, is capable of a great many different interpretations, and properly signifies only whatever is beautiful or transparent. Dr Merret will have the art to be as ancient as that of pottery or the making of bricks, for the reasons already given, viz. that by all vehement heat some imperfect vitrifications are produced. Of this kind undoubtedly was the fossil glass mentioned by Ferant. Imperator. to have been found under ground where great fires had been. But it is evident, that such imperfect vitrifications might have passed unnoticed for ages; and consequently we have no reason to conclude from thence, that the art of glass-making is of such high antiquity.

The Egyptians boast, that this art was taught them by their great Hermes. Aristophanes, Aristotle, Alexander Aphrodiseus, Lucretius, and St John the divine, put it out of all doubt that glass was used in their days. Pliny relates, that it was first discovered accidentally in Syria, at the mouth of the river Belus, by certain merchants driven thither by a storm at sea; who being obliged to continue there and dress their victuals by making a fire on the ground, where there was great plenty of the herb kali; that plant, burning to ashes, its salts mixed and incorporated with the sand, or stones fit for vitrification, and thus produced glass; and that, this accident being known, the people of Sidon in that neighbourhood essayed the work, and brought glass into use; since which time the art has been continually improving. Be this as it will, however, the first glass-houses mentioned in history were erected in the city of Tyre, and here was the only staple of the manufacture for many ages. The sand which lay on the shore for about half a mile round the mouth of the river Belus was peculiarly adapted to the making of glass, as being neat and glittering; and the wide range of the Tyrian commerce, gave an ample vent for the productions of the furnace.

Mr Nixon, in his observations on a plate of glass found at Herculaneum, which was destroyed A. D. 80, on which occasion Pliny lost his life, offers several probable conjectures as to the uses to which such plates might be applied. Such plates, he supposes, might serve for *specula* or looking glasses; for Pliny, in speaking of Sidon, adds, *siquidem etiam specula excogitaverat:* the reflection of images from these ancient specula being effected by besmearing them behind, or tinging them through with some dark colour. Another use in which they might be employed, was for adorning the walls of their apartments, by way of wainscot, to which Pliny is supposed to refer by his *vitreæ cameræ*, lib. xxxvi. cap. 25. § 64. Mr Nixon farther conjectures, that these glass plates might be used for windows, as well as the lamina of *lapis specularis* and *phengites*, which were improvements in luxury mentioned by Seneca and introduced in his time, Ep. xc. However, there is no positive authority relating to the usage of glass windows earlier than the close of the third century: *Manifestius est* (says Lactantius*), *mentem esse, quæ per oculos ea quæ sunt opposita, transpiciat, quasi per fenestras lucente vitro aut speculari lapide obductas.*

* *De opif. Dei*, cap. 5.

The first time we hear of glass made among the Romans was in the reign of Tiberius, when Pliny relates that an artist had his house demolished for making glass malleable, or rather flexible; though Petronius Arbiter, and some others, assure us, that the emperor ordered the artist to be beheaded for his invention.

It appears, however, that before the conquest of Britain by the Romans, glass-houses had been erected in this island, as well as in Gaul, Spain, and Italy.—Hence, in many parts of the country are to be found amulets of glass, having a narrow perforation and thick rim, denominated by the remaining Britons *gleineu naidreedh* or *glass adders*, and which were probably in former times used as amulets by the druids †. It can scarcely be questioned that the Britons were sufficiently well versed in the manufacture of glass, to form out of it many more useful instruments than the glass beads. History indeed assures us, that they did manufacture a considerable quantity of glass vessels. These, like their amulets, were most probably green, blue, yellow, or black, and many of them curiously streaked with other colours. The process in the manufacture would be nearly the same with that of the Gauls or Spaniards. The sand of their shores being reduced to a sufficient degree of fineness by art, was mixed with three-fourths of

† See *Anguinum Ovum.*

Glass.

of its weight of their nitre (much the same with our kelp), and both were melted together. The metal was then poured into other vessels, where it was left to harden into a mass, and afterwards replaced in the furnace, where it became transparent in the boiling, and was afterwards figured by blowing, or modelling in the lath, into such vessels as they wanted.

It is not probable that the arrival of the Romans would improve the glass manufacture among the Britons. The taste of the Romans at that time was just the reverse of that of the inhabitants of this island. The former preferred silver and gold to glass for the composition of their drinking vessels. They made indeed great improvements in their own at Rome, during the government of Nero. The vessels then formed of this metal rivalled the bowls of porcelain in their dearness, and equalled the cups of crystal in their transparency. But these were by far too costly for common use; and therefore, in all probability, were never attempted in Britain. The glass commonly made use of by the Romans was of a quality greatly inferior; and, from the fragments which have been discovered at the stations or towns of either, appears to have consisted of a thick, sometimes white, but mostly blue green, metal.

According to venerable Bede, artificers skilled in making glass for windows were brought over into England in the year 674, by Abbot Benedict, who were employed in glazing the church and monastery of Weremouth. According to others, they were first brought over by Wilfrid, bishop of Worcester, about the same time. Till this time the art of making such glass was unknown in Britain; though glass windows did not begin to be common before the year 1180; till this period they were very scarce in private houses, and considered as a kind of luxury, and as marks of great magnificence. Italy had them first, next France, from whence they came into England.

Venice, for many years, excelled all Europe in the fineness of its glasses; and in the thirteenth century, the Venetians were the only people that had the secret of making crystal looking glasses. The great glass works were at Muran, or Murano, a village near the city, which furnished all Europe with the finest and largest glasses.

The glass manufacture was first begun in England in 1557: the finer sort was made in the place called Crutched Friars, in London; the fine flint glass, little inferior to that of Venice, was first made in the Savoy house, in the Strand, London. This manufacture appears to have been much improved in 1635, when it was carried on with sea coal or pit coal instead of wood, and a monopoly was granted to Sir Robert Mansell, who was allowed to import the fine Venetian flint glasses for drinking, the art of making which was not brought to perfection before the reign of William III. But the first glass plates, for looking glasses and coach windows, were made, 1673, at Lambeth, by the encouragement of the duke of Buckingham; who, in 1670, introduced the manufacture of fine glass into England, by means of Venetian artists, with amazing success. So that within a century past, the French and English have not only come up to, but even surpassed the Venetians, and we are now no longer supplied from abroad.

The French made a considerable improvement in the art of glass, by the invention of a method to cast very large plates, till then unknown, and scarce practised yet by any but themselves and the English. That court applied itself with a laudable industry to cultivate and improve the glass manufacture. A company of glassmen was established by letters patent; and it was provided by an arret, not only that the working in glass should not derogate any thing from nobility, but even that none but nobles should be allowed to work therein.

An extensive manufactory of this elegant and valuable branch of commerce was first established in Lancashire, about the year 1773, through the spirited exertions of a very respectable body of proprietors, who were incorporated by an act of parliament. From those various difficulties constantly attendant upon new undertakings, when they have to contend with powerful foreign establishments, it was for some time considerably embarrassed; but government, of late, having taken off some restrictions that bore hard upon it, and made some judicious regulations relative to the mode of levying the excise duty, it now bids fair to rival, if not surpass, the most celebrated continental manufactures, both with respect to the quality, brilliancy, and size of its productions.

2 Theory of vitrification uncertain.

With regard to the theory of vitrification, we are almost totally in the dark. In general, it seems to be that state in which solid bodies are, by the vehement action of fire, fitted for being dissipated or carried off in vapour. In all vitrifications there is a plentiful evaporation: and if any solid substance is carried off in vapour by the intense heat of a burning speculum, a vitrification is always observed previously to take place. The difference, then, between the state of fusion and vitrification of a solid body we may conceive to be, that in the former the element of fire acts upon the parts of the solid in such a manner as only to disjoin them, and render the substance fluid; but in vitrification the fire not only disjoins the particles, but combines with them in a latent state into a third substance; which, having now as much fire as it can contain, can receive no further change from that element except being carried off in vapour.

But though we are unable to effect this change upon solid bodies without a very violent heat, it is otherwise in the natural processes. By what we call *crystallization*, nature produces more perfect glasses than we can make with our furnaces. These are called *precious stones*; but in all trials they discover the essential properties of glass, and not of stones. The most distinguishing property of glass is its resisting the force of fire, so that this element cannot calcine or change it as it does other bodies, but can only melt it, and then carry it off in vapours. To this last all the precious stones are subject. The diamond (the hardest of them all) may be dissipated in a less degree of heat than what would dissipate common glass. Nor can it be any objection to this idea, that some kinds of glass are capable of being converted into a kind of porcelain by a long-continued cementation with certain materials. This change happens only to those kinds of glass which are made of alkaline salt and sand; and Dr Lewis hath shown that this change is produced by the dissipation of the saline principle, which is the least fixed of the two. Glass, therefore, we may still consider as a substance upon which the fire has

Glass. has no other effect than either to melt or dissipate it in vapour.

The other properties of glass are very remarkable, some of which follow:

3 Remarkable properties of glass.

1. It is one of the most elastic bodies in nature. If the force with which glass balls strike each other be reckoned 16, that wherewith they recede by virtue of their elasticity will be nearly 15.

2. When glass is suddenly cooled, it becomes exceedingly brittle; and this brittleness is sometimes attended with very surprising phenomena. Hollow balls made of unannealed glass, with a small hole in them, will fly to pieces by the heat of the hand only, if the hole by which the internal and external air communicate be stopped with a finger. Some vessels, however, made of such unannealed glass have been discovered, which have the remarkable property of resisting very hard strokes given from without, though they shiver to pieces by the shocks received from the fall of very light and minute bodies dropped into their cavities. These glasses may be made of any shape: all that needs be observed in making them is, that their bottom be thicker than their sides. The thicker the bottom is, the easier do the glasses break. One whose bottom is three fingers breadth in thickness flies with as much ease at least as the thinnest glass. Some of these vessels have been tried with strokes of a mallet sufficient to drive a nail into wood tolerably hard, and have held good without breaking. They have also resisted the shock of several heavy bodies, let fall into their cavities, from the height of two or three feet; as musket balls, pieces of iron or other metal, pyrites, jasper, wood, bone, &c. But this is not surprising, as other glasses of the same shape and size will do the same: but the wonder is, that taking a shiver of flint of the size of a small pea, and letting it fall into the glass only from the height of three inches, in about two seconds, the glass flies, and sometimes at the very moment of the shock; nay, a bit of flint no larger than a grain, dropped into several glasses successively, though it did not immediately break them, yet when set by, they all flew in less than three quarters of an hour. Some other bodies produce the same effect with flint; as sapphire, diamond, porcelain, hard tempered steel; also marbles such as boys play with, and likewise pearls.

4 Surprising fragility of unannealed glass.

These experiments were made before the Royal Society; and succeeded equally when the glasses were held in the hand, when they were rested on a pillow, put in water, or filled with water. It is also remarkable, that the glasses broke upon having their bottoms slightly rubbed with the finger, though some of them did not fly till half an hour after the rubbing. If the glasses are everywhere extremely thin, they do not break in these circumstances.

5 Attempts to account for it.

Some have pretended to account for these phenomena, by saying, that the bodies dropped into the vessels cause a concussion which is stronger than the cohesive force of the glass, and consequently that a rupture must ensue. But why does not a ball of iron, gold, silver, or copper, which are perhaps a thousand times heavier than the flint, produce the same effect? It is because they are not elastic. But surely iron is more elastic than the end of one's finger. Mr Euler has endeavoured to account for these appearances from his principles of percussion. He thinks that this experiment entirely overthrows the opinion of those who measure the force of percussion by the *vis viva*, or absolute apparent strength of the stroke. According to his principles, the great hardness and angular figure of the flint, which makes the space of contact with the glass extremely small, ought to cause an impression on the glass vastly greater than lead, or any other metal; and this may account for the flint's breaking the vessel, though the bullet, even falling from a considerable height, does no damage. Hollow cups made of green bottle glass, some of them three inches thick at the bottom, were instantly broken by a shiver of flint weighing about two grains, though they had resisted the shock of a musket ball from the height of three feet.

That Mr Euler's theory cannot be conclusive more than the other, must appear evident from a very slight consideration. It is not by angular bodies alone that the glasses are broken. The marbles with which children play are round, and yet they have the same effect with the angular flint. Besides, if it was the mere force of percussion which broke the glasses, undoubtedly the fracture would always take place at the very instant of the stroke; but we have seen that this did not happen sometimes till a very considerable space of time had elapsed. It is evident, therefore, that this effect is occasioned by the putting in motion some subtle fluid with which the substance of the glass is filled; and that the motions of this fluid, when once excited in a particular part of the glass, soon propagate themselves through the whole or greatest part of it, by which means the cohesive power becomes at last too weak to resist them. There can be little doubt that the fluid just now mentioned is that of electricity. It is known to exist in glass in very great quantity; and it also is known to be capable of breaking glasses even when annealed with the greatest care, if put into too violent a motion. Probably the cooling of glass hastily may make it more electric than is consistent with its cohesive power, so that it is broken by the least increase of motion in the electric fluid by friction or otherwise. This is evidently the case when it is broken by rubbing with the finger; but why it should also break by the mere contact of flint and the other bodies above mentioned, has not yet been satisfactorily accounted for.

A most remarkable phenomenon also is produced in glass tubes placed in certain circumstances. When these are laid before a fire in a horizontal position, having their extremities properly supported, they acquire a rotatory motion round their axis, and also a progressive motion towards the fire, even when their supports are declining from the fire, so that the tubes will move a little way up hill towards the fire. When the progressive motion of the tubes towards the fire is stopped by any obstacle, their rotation still continues. When the tubes are placed in a nearly upright posture, leaning to the right hand, the motion will be from east to west; but if they lean to the left hand, their motion will be from west to east; and the nearer they are placed to the perfectly upright posture, the less will the motion be either way. 6 Rotation of glass tubes before a fire.

If the tube is placed horizontally on a glass pane, the fragment, for instance, of coach window-glass, instead

Glass.

stead of moving towards the fire, it will move from it, and about its axis in a contrary direction to what it had done before; nay, it will recede from the fire, and move a little up hill when the plane inclines towards the fire. These experiments are recorded in the Philosophical Transactions *. They succeeded best with tubes about 20 or 22 inches long, which had in each end a pretty strong pin fixed in cork for an axis.

* No. 476. § 1.

7 Attempts to account for it.

The reason given for these phenomena, is the swelling of the tubes towards the fire by the heat, which is known to expand all bodies. For, say the adopters of this hypothesis, granting the existence of such a swelling, gravity must pull the tube down when supported near its extremities; and a fresh part being exposed to the fire, it must also swell out and fall down, and so on.—But without going farther in the explanation of this hypothesis, it may be here remarked, that the fundamental principle on which it proceeds is false; for though fire indeed make bodies expand, it does not increase them in weight; and therefore the sides of the tube, though one of them is expanded by the fire, must still remain *in equilibrio;* and hence we must conclude, that the causes of these phenomena remain yet to be discovered.

4. Glass is less dilatable by heat than metalline substances, and solid glass sticks are less dilatable than tubes. This was first discovered by Col. Roy, in making experiments in order to reduce barometers to a greater degree of exactness than hath hitherto been found practicable; and since his experiments were made, one of the tubes 18 inches long, being compared with a solid glass rod of the same length, the former was found by a pyrometer to expand four times as much as the other, in a heat approaching to that of boiling oil.—On account of the general quality which glass has of expanding less than metal, M. de Luc recommends it to be used in pendulums: and he says it has also this good quality, that its expansions are always equable, and proportioned to the degrees of heat; a quality which is not to be found in any other substance yet known.

Phil. Trans. vol. lxvii. p. 663.

Ibid. vol. lxviii. p. 474.

5. Glass appears to be more fit for the condensation of vapours than metallic substances. An open glass filled with water, in the summer time, will gather drops of water on the outside, just as far as the water in the inside reaches; and a person's breath blown on it manifestly moistens it. Glass also becomes moist with dew, when metals do not. See Dew.

6. A drinking glass partly filled with water, and rubbed on the brim with a wet finger, yields musical notes, higher or lower as the glass is more or less full; and will make the liquor frisk and leap. See Harmonica.

7. Glass is possessed of very great electrical virtues. See Electricity, *passim.*

8 Materials for glass.

Materials for Making of Glass. The materials whereof glass is made, we have already mentioned to be salt and sand or siliceous earth.

1. The salt here used is procured from a sort of ashes brought from the Levant, called *polverine*, or *rochetta;* which ashes are those of a sort of water plant called *kali* †, cut down in the summer, dried in the sun, and burnt in heaps, either on the ground or on iron grates; the ashes falling into a pit, grow into a hard mass, or stone, fit for use. It may also be procured from common kelp, or the ashes of the *fucus vesiculosus*. See Kelp.

† See *Salsola*, *Botany Index.*

To extract the salt, these ashes, or polverine, are powdered and sifted, then put into boiling water, and there kept till one-third of the water be consumed; the whole being stirred up from time to time, that the ashes may incorporate with the fluid, and all its salts be extracted: then the vessel is filled up with new water, and boiled over again, till one half be consumed; what remains is a sort of ley, strongly impregnated with salt. This ley, boiled over again in fresh coppers, thickens in about 24 hours, and shoots its salt; which is to be ladled out, as it shoots, into earthen pans, and thence into wooden vats to drain and dry. This done, it is grossly pounded, and thus put in a sort of oven, called *calcar*, to dry. It may be added, that there are other plants, besides kali and fucus which yield a salt fit for glass: such are the common way thistle, bramble, hops, wormwood, woad, tobacco, fern, and the whole leguminous tribe, as pease, beans, &c.

Pearl ashes form a leading flux in the manufacture of glass, and mostly supply the place of the Levant ashes, the barillas of Spain, and many other kinds, which were formerly brought here for making both glass and soap.

There are other fluxes used for different kinds of glass, and for various purposes, as calcined lead, nitre, sea salt, borax, arsenic, smiths clinkers, and wood-ashes, containing the earth and lixiviate salts as produced by incineration. With regard to these several fluxes, we may observe, in general, that the more calx of lead, or other metallic earth, enters into the composition of any glass, so much the more fusible, soft, coloured, and dense this glass is, and reciprocally.

The colours given to glass by calces of lead, are shades of yellow: on the other hand, glasses that contain only saline fluxes partake of the properties of salts; they are less heavy, less dense, harder, whiter, more brilliant, and more brittle than the former; and glasses containing both saline and metallic fluxes do also partake of the properties of both these substances. Glasses too saline are easily susceptible of alteration by the action of air and water: especially those in which alkalies prevail; and these are also liable to be injured by acids. Those that contain too much borax and arsenic, though at first they appear very beautiful, quickly tarnish and become opake when exposed to air. By attending to these properties of different fluxes, phlogistic or saline, the artist may know how to adjust the proportions of these to sand, or powdered flints, for the various kinds of glass. See the article Vitrification.

2. The sand or stone, called by the artists *tarso*, is the second ingredient in glass, and that which gives it the body and firmness. These stones, Agricola observes, must be such as will fuse; and of these such as are white and transparent are best; so that crystal challenges the precedency of all others.

At Venice they chiefly use a sort of pebble, found in the river Tesino, resembling white marble, and called *cuogolo*. Indeed Ant. Neri assures us, that all stones which will strike fire with steel, are fit to vitrify; but Dr Morret shows, that there are some exceptions from this

this rule. Flints are admirable; and when calcined, powdered, and searced, make a pure white crystalline metal; but the expence of preparing them makes the masters of our glass-houses sparing of their use. Where proper stones cannot be so conveniently had, sand is used. The best for this purpose is that which is white, small, and shining; examined by the microscope, it appears to be small fragments of rock crystal. For green glass, that which is of a soft texture, and more gritty; it is to be well washed, which is all the preparation it needs. Our glass-houses are furnished with white sand for their crystal glasses from Lynn in Norfolk, and Maidstone in Kent, and with the coarser for green glass from Woolwich.

Some mention a third ingredient in glass, viz. manganese, a kind of pseudo loadstone, dug up in Germany, Italy, and even in Mendip hills in Somersetshire. But the proportion hereof to the rest is very inconsiderable; beside, that it is not used in all glass. Its office is to purge off the natural greenish colour, and give it some other tincture required.

For this purpose it should be chosen of a deep colour, and free from specks of metalline appearance, or a lighter cast; manganese requires to be well calcined in a hot furnace, and then to undergo a thorough levigation. The effect of manganese in destroying the colours of glass, and hence called the soap of glass, is accounted for by M. Montamy, in his *Traité des Couleurs pour la Peinture en Email*, in the following manner: the manganese destroys the green, olive, and blue colours of glass, by adding to them a purple tinge, and by the mixture producing a blackish brown colour; and as blackness is caused merely by an absorption of the rays of light, the blackish tinge given to the glass by the mixture of colours, prevents the reflection of so many rays, and thus renders the glass less coloured than before. But the black produced by this substance suggests an obvious reason for using it very sparingly in those compositions of glass which are required to be very transparent. Nitre or saltpetre is also used with the same intention; for by destroying, in a certain degree, the inflammable or carbonaceous matter, which gives a strong tinge of yellow to glass prepared with lead as a flux, it serves to free it from this colour; and in saline glasses, nitre is requisite in a smaller proportion to render them sufficiently transparent, as in the case of looking glass and other kinds of plates.

Kinds of Glass. The manufactured glass now in use may be divided into three general kinds; white transparest glass, coloured glass, and common green or bottle glass. Of the first kind there is a great variety; as the flint glass, as it is called with us, and the German crystal glass, which are applied to the same uses; the glass for plates, for mirrors, or looking glasses; the glass for windows and other lights; and the glass for phials and small vessels. And these again differ in the substances employed as fluxes in forming them, as well as in the coarseness or fineness of such as are used for their body. The flint and crystal, mirror and best window glass, not only require such purity in the fluxes, as may render it practicable to free the glass perfectly from all colour; but for the same reason likewise, either the white Lynn sand, calcined flints, or white pebbles, should be used. The others do not demand the same nicety in the choice of the materials; though the second kind of window glass, and the best kind of phial, will not be so clear as they ought, if either too brown sand or impure salts be suffered to enter into their composition.

Of coloured glass there is a great variety of sorts, differing in their colour or other properties according to the occasions for which they are wanted. The differences in the latter kind depend on the accidental preparation and management of the artists by whom they are manufactured, as will be afterwards explained.

Furnaces for the Making of Glass. In this manufacture there are three sorts of furnaces; one called *calcar* is for the frit; the second is for working the glass; the third serves to anneal the glass, and is called the *leer*. See Plate CCXLVII.

The calcar resembles an oven ten feet, long, seven feet broad, and two deep; the fuel, which in Britain is sea coal, is put into a trench on one side of the furnace, and the flame reverberating from the roof upon the frit calcines it. The glass furnace, or working furnace, is round, of three yards diameter, and two high: or thus proportioned. It is divided into three parts, each of which is vaulted. The lower part is properly called the *crown*, and is made in that form. Its use is to keep a brisk fire, which is never put out. The mouth is called the *bocca*. There are several holes in the arch of this crown, through which the flame passes into the second vault or partition, and reverberates into the pots filled with the ingredients above mentioned. Round the insides are eight or more pots placed, and piling pots on them. The number of pots is always double that of the boccas or mouths, or of the number of workmen, that each may have one pot refined to work out of, and another for metal to refine in while he works out of the other. Through the working holes the metal is taken out of the pots, and the pots are put into the furnace; and these holes are stopped with moveable covers made of lute and brick, to screen the workmen's eyes from the scorching flames. On each side of the bocca or mouth is a bocarella or little hole, out of which coloured glass or finer metal is taken from the piling pot. Above this oven there is the third oven or *leer*, above five or six yards long, where the vessels or glass are annealed or cooled: this part consists of a tower, besides the leer, into which the flame ascends from the furnace. The tower has two mouths, through which the glasses are put in with a fork, and set on the floor or bottom: but they are drawn out on iron pans called *fraches*, through the leer, to cool by degrees; so that they are quite cold by the time they reach the mouth of the leer, which enters the sarosel or room where the glasses are to be stowed.

But the green-glass furnace is square; and at each angle it has an arch for annealing or cooling glasses. The metal is wrought on two opposite sides, and on the other two they have their colours, into which are made linnet holes for the fire to come from the furnace to bake the frit, and to discharge the smoke. Fires are made in the arches to anneal the work, so that the whole process is done in one furnace.

These furnaces must not be of brick, but of hard sandy stones. In France, they build the outside of brick; and the inner part, to bear the fire, is made of a

sort

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sort of fullers earth, or tobacco-pipe clay, of which earth they also make their melting pots. In Britain the pots are made of Stourbridge clay.

Mr Blancourt observes that the worst and roughest work in this art is the changing the pots when they are worn out or cracked. In this case the great working hole must be uncovered; the faulty pot must be taken out with iron hooks and forks, and a new one must be speedily put in its place, through the flames, by the hands only. For this work, the man guards himself with a garment made of skins, in the shape of a pantaloon, that covers him all but his eyes, and is made as wet as possible; the eyes are defended with a proper sort of glass.

Instruments for Making of Glass. The instruments made use of in this work may be reduced to these that follow. A blowing pipe, made of iron, about two feet and a half long, with a wooden handle. An iron rod to take up the glass after it is blown, and to cut off the former. Scissars to cut the glass when it comes off from the first hollow iron. Shears to cut and shape great glasses, &c. An iron ladle with the end of the handle cased with wood, to take the metal out of the refining pot, to put it into the workman's pots. A small iron ladle cased in the same manner, to skim the alkalic salt that swims at top. Shovels, one like a peel, to take up the great glasses; another like a fire-shovel, to feed the furnace with coals. A hooked iron fork, to stir the matter in the pots. An iron rake for the same purpose, and to stir the frit. An iron fork, to change or pull the pots out of the furnace, &c.

Compositions for White and Crystal Glass. 1. To make *crystal glass*, take of the whitest tarso, pounded small, and searced as fine as flour, 200 pounds; of the salt of polverine 130 pounds; mix them together and put them into the furnace called the *calcar*, first heating it. For an hour keep a moderate fire, and keep stirring the materials with a proper rake, that they may incorporate and calcine together; then increase the fire for five hours; after which take out the matter; which being now sufficiently calcined, is called *frit*. From the calcar put the frit in a dry place, and cover it up from the dust for three or four months. Now to make the glass or crystal: take of this crystal frit, called also *bollito*; set it in pots in the furnace, adding to it a due quantity of magnesia or manganese: when the two are fused, cast the fluor into fair water, to clear it of the salt called *sandiver*; which would otherwise make the crystal obscure and cloudy. This lotion must be repeated again and again, as often as needful, till the crystal be fully purged; or this scum may be taken off by means of proper ladles. Then set it to boil four, five, or six days; which done, see whether it have manganese enough; and if it be yet greenish, add more manganese, at discretion, by little and little at a time, taking care not to overdose it, because the manganese inclines it to a blackish hue. Then let the metal clarify, till it becomes of a clear and shining colour; which done, it is fit to be blown or formed into vessels at pleasure.

2. *Flint glass*, as it is called by us, is of the same general kind with that which in other places is called crystal glass. It has this name from being originally made with calcined flints, before the use of the white sand was understood; and retains the name, though no flints are now used in the composition of it. This flint glass differs from the other, in having lead for its flux, and white sand for its body; whereas the fluxes used for the crystal glass are salts or arsenic, and the body consists of calcined flints or white river pebbles, tarso, or such stones. To the white sand and lead a proper proportion of nitre is added, to burn away the phlogiston of the lead, and also a small quantity of magnesia; and in some works they use a proportional quantity of arsenic to aid the fluxing ingredients. The most perfect kind of glass may be made by fusing with a very strong fire 120 pounds of the white sand, 50 pounds of red lead, 40 pounds of the best pearl ashes, 20 pounds of nitre, and five ounces of magnesia. Another composition of flint glass, which is said to come nearer to the kind now made, is the following: 120 pounds of sand, 54 pounds of the best pearl ashes, 36 pounds of red lead, 12 pounds of nitre, and 6 ounces of magnesia. To either of these a pound or two of arsenic may be added, to increase the flux of the composition. A cheaper composition of flint glass may be made with 120 pounds of white sand, 35 pounds of the best pearl ashes, 40 pounds of red lead, 13 pounds of nitre, 6 pounds of arsenic, and four ounces of magnesia; or instead of the arsenic may be substituted 15 pounds of common salt; but this will be more brittle than the other. The cheapest composition for the worst kind of flint glass consists of 120 pounds of white sand, 30 pounds of red lead, 20 pounds of the best pearl ashes, 10 pounds of nitre, 15 pounds of common salt, and six pounds of arsenic. The best German crystal glass is made of 120 pounds of calcined flints or white sand, 70 pounds of the best pearl ashes, 10 pounds of saltpetre, half a pound of arsenic, and five ounces of magnesia. And a cheaper composition is formed of 120 pounds of calcined flints or white sand, 46 pounds of pearl ashes, 7 pounds of nitre, 6 pounds of arsenic, and 5 ounces of magnesia.

A glass much harder than any prepared in the common way, may be made by means of borax in the following method: Take four ounces of borax, and an ounce of fine sand; reduce both to a subtile powder, and melt them together in a large close crucible set in a wind furnace, keeping up a strong fire for half an hour; then take out the crucible, and when cold break it, and there will be found at the bottom a pure hard glass capable of cutting common glass like a diamond. This experiment, duly varied, says Dr Shaw, may lead to several useful improvements in the arts of glass, enamels, and factitious gems, and shows an expeditious method of making glass, without any fixed alkali, which has been generally thought an essential ingredient in glass, and it is not yet known whether calcined crystal or other substances being added to this salt instead of sand, it might not make a glass approaching to the nature of a diamond.

There are three principal kinds of glasses, distinguished by the form or manner of working them; viz. I. *Round glass*, as those of our vessels, phials, drinking glasses, &c. II. *Table* or *window glass*, of which there are divers kinds; viz. crown glass, jealous glass, &c. III. *Plate glass*, or *mirror glass*.

I. *Working or Blowing Round Glass.* The working furnace, we have observed, is round, and has six boccas

 or

or apertures: at one of these, called the *great bocca*, the furnace is heated, and the pots of frit are at this set in the furnace; two other small holes, called *bocarellas*, serve to lade or take out the melted metal, at the end of an iron, to work the glass. At the other holes they put in pots of fusible ingredients, to be prepared, and at last emptied into the lading pot.

There are six pots in each furnace, all made of tobacco-pipe clay, proper to sustain not only the heat of the fire, but also the effect of the polverine, which penetrates every thing else. There are only two of these pots that work: the rest serve to prepare the matter for them. The fire of the furnace is made and kept up with dry hard wood, cast in without intermission at six apertures.

When the matter contained in the two pots is sufficiently vitrified, they proceed to blow or fashion it. For this purpose the workman dips his blowing pipe into the melting pot; and by turning it about, the metal sticks to the iron more firmly than turpentine. This he repeats four times, at each time rolling the end of his instrument, with the hot metal thereon, on a piece of plate iron; over which is a vessel of water which helps to cool, and so to consolidiate and to dispose that matter to bind more firmly with what is to be taken next out of the melting pot. But after he has dipt a fourth time, and the workman perceives there is metal enough on the pipe, he claps his mouth immediately to the other end of it, and blows gently through the iron tube, till the metal lengthens like a bladder about a foot. Then he rolls it on a marble stone a little while to polish it; and blows a second time, by which he brings it to the shape of a globe of about 18 or 20 inches diameter. Every time he blows into the pipe, he removes it quickly to his cheek; otherwise he would be in danger, by often blowing, of drawing the flame into his mouth: and this globe may be flattened by returning it to the fire; and brought into any form by stamp irons, which are always ready. When the glass is thus blown, it is cut off at the collet or neck; which is the narrow part that stuck to the iron. The method of performing this is as follows: the pipe is rested on an iron bar, close by the collet; then a drop of cold water being laid on the collet, it will crack about a quarter of an inch, which, with a slight blow or cut of the shears will immediately separate the collet.

After this is done, the operator dips the iron rod into the melting pot, by which he extracts as much metal as serves to attract the glass he has made, to which he now fixes this rod at the bottom of his work, opposite to the opening made by the breaking of the collet. In this position the glass is carried to the great bocca or mouth of the oven, to be heated and scalded; by which means it is again put into such a soft state, that, by the help of an iron instrument, it can be pierced, opened, and widened, without breaking. But the vessel is not finished till it is returned to the great bocca; where being again heated thoroughly, and turned quickly about with a circular motion, it will open to any size, by the means of the heat and motion.

If there remain any superfluities, they are cut off with the shears; for till the glass is cool, it remains in a soft flexible state. It is therefore taken from the bocca, and carried to an earthen bench, covered with brands, which are coals extinguished, keeping it turning; because that motion prevents any settling, and preserves an evenness in the face of the glass, where, as it cools, it comes to its consistency; being first cleared from the iron rod by a slight stroke by the hand of the workman.

If the vessel conceived in the workman's mind, and whose body is already made, requires a foot, or a handle, or any other member or decoration, he makes them separately; and now essays to join them with the help of hot metal, which he takes out of the pots with his iron rod: but the glass is not brought to its true hardness till it has passed the leer or annealing oven, described before.

II. *Working or blowing of Window or Table* Glass. The method of working round glass, or vessels of any sort, is in every particular applicable to the working of window or table glass, till the blowing iron has been dipt the fourth time. But then instead of rounding it, the workman blows, and so manages the metal upon the iron plate, that it extends two or three feet in the form of a cylinder. This cylinder is put again to the fire, and blown a second time, and is thus repeated till it is extended to the dimensions required, the side to which the pipe is fixed diminishing gradually till it ends in a pyramidal form; so that, to bring both ends nearly to the same diameter, while the glass is thus flexible, he adds a little hot metal to the end opposite the pipe, and draws it out with a pair of iron pincers, and immediately cuts off the same end with the help of a little cold water as before.

The cylinder being now open at one end, is carried back to the bocca; and there, by the help of cold water, it is cut about eight or ten inches from the iron pipe or rod; and the whole length at another place, by which also it is cut off from the iron rod. Then it is heated gradually on an earthen table, by which it opens in length; while the workman, with an iron tool, alternately lowers and raises the two halves of the cylinder; which at last will open like a sheet of paper, and fall into the same form in which it serves for use; in which it is preserved by heating it over again, cooling it on a table of copper, and hardening it 24 hours in the annealing furnace, to which it is carried upon forks. In this furnace an hundred tables of glass may lie at a time, without injury to each other, by separating them into tents, with an iron shiver between, which diminishes the weight by dividing it, and keeps the tables flat and even.

Of window or table glass there are various sorts, made in different places, for the use of building. Those most known among us are given us by the author of the Builder's Dictionary, as follows:

1. *Crown*, of which, says Neri, there are two kinds, distinguished by the places where they are wrought; viz. Ratcliff crown glass, which is the best and clearest, and was first made at the Bear garden, on the Bankside, Southwark, but since at Ratcliff: of this there are 24 tables to the case, the tables being of a circular form, about three feet six inches in diameter. The other kind, or Lambeth crown glass, is of a darker colour than the former, and more inclining to green.

The best window or crown glass is made of white sand 60 pounds, of purified pearl ashes 30 pounds, of saltpetre

saltpetre 15 pounds, of borax one pound, and of arsenic half a pound. If the glass should prove yellow, magnesia must be added. A cheaper composition for window glass consists of 60 pounds of white sand, 25 pounds of unpurified pearl ashes, 10 pounds of common salt, 5 pounds of nitre, 2 pounds of arsenic, and one ounce and a half of magnesia. The common or green window glass is composed of 60 pounds of white sand, 60 pounds of unpurified pearl ashes, 10 pounds of common salt, 2 pounds of arsenic, and 2 ounces of magnesia. But a cheaper composition for this purpose consists of 120 pounds of the cheapest white sand, 30 pounds of unpurified pearl ashes, 60 pounds of wood ashes, well burnt and sifted, 20 pounds of common salt, and 5 pounds of arsenic.

2. *French glass*, called also *Normandy glass*, and formerly *Lorraine glass*, because made in those provinces. At present it is made wholly in the nine glass works; five whereof are in the forest of Lyons, four in the county of Eu; the last at Beaumont near Rouen. It is of a thinner kind than our crown glass; and when laid on a piece of white paper, appears of a dirtyish green colour. There are but 25 tables of this to the case.

3. *German glass* is of two kinds, the *white* and the *green*: the first is of a whitish colour, but is subject to those small curved streaks observed in our Newcastle glass, though free from the spots and blemishes thereof. The green, besides its colour, is liable to the same streaks as the white; but both of them are straighter and less warped than our Newcastle glass.

4. *Dutch glass* is not much unlike our Newcastle glass either in colour or price. It is frequently much warped like that, and the tables are but small.

5. *Newcastle glass* is that most used in England. It is of an ash colour, and much subject to specks, streaks, and other blemishes; and besides is frequently warped. Leybourn says, there are 45 tables to the case, each containing five superficial feet: some say there are but 35 tables, and six feet in each table.

6. *Phial glass* is a kind betwixt the flint glass and the common bottle or green glass. The best kind may be prepared with 120 pounds of white sand, 50 pounds of unpurified pearl ashes, 10 pounds of common salt, 5 pounds of arsenic, and 5 ounces of magnesia. The composition for green or common phial glass consists of 120 pounds of the cheapest white sand, 80 pounds of wood ashes well burnt and sifted, 20 pounds of pearl ashes, 15 pounds of common salt, and 1 pound of arsenic.

The common bottle or green is formed of sand of any kind fluxed by the ashes of burnt wood, or of any parts of vegetables; to which may be added the *scoriæ* or clinkers of forges. When the softest sand is used, 200 pounds of wood ashes will suffice for 100 pounds of sand, which are to be ground and mixed together. The composition with the clinkers consists of 170 pounds of wood ashes, 100 pounds of sand, and 50 pounds of clinkers or *scoriæ*, which are to be ground and mixed together. If the clinkers cannot be ground, they must be broke into small pieces, and mixed with the other matter without any grinding.

III. *Working of Plate or Mirror* GLASS. 1. The materials of which this glass is made are much the same as those of other works of glass, viz. an alkali, salt and sand.

The salt, however, should not be that extracted from polverine or the ashes of the Syrian kali, but that from BARILLA, growing about Alicant in Spain. It is very rare that we can have the barilla pure; the Spaniards in burning the herb make a practice of mixing another herb along with it, which alters its quality; or of adding sand to it to increase the weight, which is easily discovered if the addition be only made after the boiling of the ashes, but next to impossible if made in the boiling. It is from this adulteration that those threads and other defects in plate glass arise. To prepare the salt, they clean it well of all foreign matters; pound or grind it with a kind of mill, and finally sift it pretty fine.

Pearl ashes, properly purified, will furnish the alkali salt requisite for this purpose; but it will be necessary to add borax or common salt, in order to facilitate the fusion, and prevent the glass from stiffening in that degree of heat in which it is to be wrought into plates. For purifying the pearl ashes, dissolve them in four times their weight of boiling water, in a pot of cast iron, always kept clean from rust. Let the solution be removed into a clean tub, and remain there 24 hours or longer. Having decanted the clear part of the fluid from the dregs or sediment, put it again in the iron pot, and evaporate the water till the salts are left perfectly dry. Preserve them in stone jars, well secured from air and moisture.

Pearl ashes may also be purified in the highest degree, so as to be proper for the manufacture of the most transparent glass, by pulverizing three pounds of the best pearl ashes with six ounces of saltpetre in a glass or marble mortar, till they are well mixed; and then putting part of the mixture into a large crucible, and exposing it in a furnace to a strong heat. When this is red hot, throw in the rest gradually; and when the whole is red hot, pour it out on a moistened stone or marble, and put it into an earthen or clean iron pot, with ten pints of water; heat it over the fire till the salts be entirely melted; let it then stand to cool, and filter it through paper in a pewter cullender. When it is filtered, put the fluid again into the pot, and evaporate the salt to dryness, which will then be as white as snow; the nitre having burnt all the phlogistic matter that remained in the pearl ashes after their former calcination.

As to the sand, it is to be sifted and washed till such time as the water come off very clear; and when it is well dried again, they mix it with the salt, passing the mixture through another sieve. This done, they lay them in the annealing furnace for about two hours; in which time the matter becomes very light and white: in this state they are called *frit* or *fritta*; and are to be laid up in a dry clean place, to give them time to incorporate: they lie here for at least a year.

When they would employ this frit, they lay it for some hours in the furnace, adding to some the fragments or shards of old and ill made glasses; taking care first to calcine the shards by heating them red hot in the furnace, and thus casting them into cold water. To the mixture must likewise be added

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ed manganese, to promote the fusion and purification.

The best composition for looking glass plates consists of 60 pounds of white sand cleansed, 25 pounds of purified pearl ashes, 15 pounds of saltpetre, and 7 pounds of borax. If a yellow tinge should affect the glass, a small proportion of magnesia, mixed with an equal quantity of arsenic, should be added. An ounce of the magnesia may be first tried; and if this proves insufficient, the quantity should be increased.

A cheaper composition for looking glass plate consists of 60 pounds of the white sand, 20 pounds of pearl ashes, 10 pounds of common salt, 7 pounds of nitre, 2 pounds of arsenic, and 1 pound of borax. The matter of which the glasses are made at the famous manufacture of St Gobin in France, is a composition of solder and of a very white sand, which are carefully cleaned of all heterogeneous bodies; afterwards washed for several times, and dried so as to be pulverized in a mill, consisting of many pestles, which are moved by horses. When this is done, the sand is sifted through silk sieves and dried.

The matter thus far prepared is equally fit for plate glass, to be formed either for blowing or by casting.

The largest glasses at St Gobin are run; the middle sized and small ones are blown.

2. *Blowing the plates.* The workhouses, furnaces, &c. used in the making of this kind of plate glass, are the same, except that they are smaller, and that the carquaisses are disposed in a large covered gallery, over against the furnace, as those in the following article, to which the reader is referred.

After the materials are vitrified by the heat of the fire, and the glass is sufficiently refined, the workman dips in his blowing iron, six feet long, and two inches in diameter, sharpened at the end which is put in the mouth, and widened at the other, that the matter may adhere to it. By this means he takes up a small ball of matter, which sticks to the end of the tube by constantly turning it. He then blows into the tube, that the air may swell the annexed ball; and carrying it over a bucket of water, which is placed on a support at the height of about four feet, he sprinkles the end of the tube to which the matter adheres, with water, still turning it, that by this cooling the matter may coalesce with the tube, and be fit for sustaining a greater weight. He dips the tube again into the same pot, and proceeds as before; and dipping it into the pot a third time, he takes it out, loaded with matter, in the shape of a pear, about ten inches in diameter, and a foot long, and cools it at the bucket; at the same time blowing into the tube, and with the assistance of a labourer, giving it a balancing motion, he causes the matter to lengthen; which, by repeating this operation several times, assumes the form of a cylinder, terminating like a ball at the bottom, and in a point at the top. The assistant is then placed on a stool three feet and a half high; and on this stool there are two upright pieces of timber, with a cross beam of the same, for supporting the glass and tube, which are kept in an oblique position by the assistant, that the master workman may with a puncheon set in a wooden handle, and with a mallet, make a hole in the mass: this hole is drilled at the centre of the ball that terminates the cylinder, and is about an inch in diameter. When the glass is pierced, the defects of it are perceived; if it is tolerably perfect, the workman lays the tube horizontally on a little iron tressel, placed on the support of the aperture of the furnace. Having exposed it to the heat for about half a quarter of an hour, he takes it away, and with a pair of long and broad shears, extremely sharp at the end, widens the glass, by insinuating the shears into the hole made with the puncheon, whilst the assistant, mounted on the stool, turns it round, till at last the opening is so large as to make a perfect cylinder at bottom. When this is done, the workman lays his glass upon the tressels at the mouth of the furnace to heat it: he then gives it to his assistant on the stool, and with large shears cuts the mass of matter up to half its height. There is at the mouth of the furnace an iron tool called *pontil*, which is now heating, that it may unite and coalesce with the glass just cut, and perform the office which the tube did before it was separated from the glass. This pontil is a piece of iron six feet long, and in the form of a cane or tube, having at the end of it a small iron bar, a foot long, laid equally upon the long one, and making with it a T. This little bar is full of the matter of the glass, about four inches thick. This red hot pontil is presented to the diameter of the glass, which coalesces immediately with the matter round the pontil, so as to support the glass for the following operation. When this is done, they separate the tube from the glass, by striking a few blows with a chissel upon the end of the tube which has been cooled; so that the glass breaks directly, and makes this separation, the tube being discharged of the glass now adhering to the pontil. They next present to the furnace the pontil of the glass, laying it on the tressel to heat, and redden the end of the glass, that the workman may open it with his shears, as he has already opened one end of it, to complete the cylinder; the assistant holding it on his stool as before. For the last time, they put the pontil on the tressel, that the glass may become red hot, and the workman cuts it quite open with his shears, right over against the forementioned cut; this he does as before, taking care that both cuts are in the same line. In the mean time, the man who looks after the carquaisses comes to receive the glass upon an iron shovel two feet and a half long without the handle, and two feet wide, with a small border of an inch and a half to the right and left, and towards the handle of the shovel. Upon this the glass is laid, flattening it a little with a small stick a foot and a half long, so that the cut of the glass is turned upwards. They separate the glass from the pontil, by striking a few gentle blows between the two with a chissel. The glass is then removed to the mouth of the hot carquaisse, where it becomes red hot gradually; the workman, with an iron tool six feet long, and widened at the end in form of a club at cards four inches long, and two inches wide on each side, very flat, and not half an inch thick, gradually lifts up the cut part of the glass to unfold it out of its form of a flattened cylinder, and render it smooth, by turning it down upon the hearth of the carquaisse. The tool already described being insinuated within the cylinder, performs this operation by being pushed hard against all the parts of the glass. When the glass is thus made quite smooth, it is pushed to the bottom of the carquaisse

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carquaisse or annealing furnace with a small iron raker, and ranged there with a little iron hook. When the carquaisse is full, it is stopped and cemented as in the case of run glasses, and the glass remains there for a fortnight to be annealed; after which time they are taken out to be polished. A workman can make but one glass in an hour, and he works and rests for six hours alternately.

Such was the method formerly made use of for blowing plate glass, looking glasses, &c.; but the workmen, by this method, could never exceed 50 inches in length, and a proportional breadth, because what were larger were always found to warp, which prevented them from reflecting the objects regularly, and wanted substance to bear the necessary grinding. These imperfections have been remedied by the following invention of the Sieur Abraham Thevart, in France, about the year 1688.

3. *Casting or Running of Large Mirror* GLASS *Plates.* The furnace is of a very large dimension, environed with several ovens, or annealing furnaces, called *carquaisses*, besides others for making of frit and calcining old pieces of glass. This furnace, before it is fit to run glass, costs 3500l. It seldom lasts above three years, and even in that time it must be refitted every six months. It takes six months to rebuild it, and three months to refit it. The melting pots are as big as large hogsheads, and contain about 2000 weight of metal. If one of them bursts in the furnace, the loss of the matter and time amounts to 250l. The materials in these pots are the same as described before. When the furnace is red hot, these materials are put in at three different times, because that helps the fusion; and in 24 hours they are vitrified, refined, settled, and fit for casting. A is the bocca, or mouth of the furnace; B is the cistern that conveys the liquid glass it receives out of the melting pots in the furnace to the casting table. These cisterns are filled in the furnace, and remain therein six hours after they are filled; and then are hooked out by the means of a large iron chain, guided by a pulley, placed upon a carriage with four wheels marked C, by two men. This carriage has no middle piece; so that when it has brought the cistern to the casting table D, they slip off the bottom of the cistern, and out rushes a torrent of flaming matter upon the table: this matter is confined to certain dimensions by the iron rulers EE, which are moveable, retain the fluid matter, and determine the width of the glass; while a man, with the roller F resting on the edge of the iron rulers, reduceth it as it cools to an equal thickness, which is done in the space of a minute. This table is supported on a wooden frame, with trustles for the convenience of moving to the annealing furnace; into which, strewed with sand, the new plate is shoved, where it will harden in about 10 days.

Plate CCXLVII. fig. 2.

What is most surprising throughout the whole of this operation, is the quickness and address wherewith such massy cisterns, filled with a flaming matter, are taken out of the furnace, conveyed to the table, and poured therein, the glass spread, &c. The whole is inconceivable to such as have not been eye witnesses of that surprising manufacture.

As fast as the cisterns are emptied, they carry them back to the furnace and take fresh ones, which they empty as before. Thus they continue to do so long as there are any full cisterns; laying as many plates in each carquaisse as it will hold, and stopping them up with doors of baked earth, and every chink with cement, as soon as they are full, to let them anneal, and cool again, which requires about 14 days.

The first running being dispatched, they prepare another, by filling the cisterns anew from the matter in the pots; and after the second, a third; and even a fourth time, till the melting pots are quite empty.

The cisterns at each running should remain at least six hours in the furnace to whiten; and when the first annealing furnace is full, the casting table is to be carried to another. It need not here be observed, that the carquaisses, or annealing furnaces, must first have been heated to the degree proper for them. It may be observed, that the oven full, or the quantity of matter, commonly prepared, supplies the running of 18 glasses, which is performed in 18 hours, being an hour for each glass. The workmen work six hours, and are then relieved by others.

When the pots are emptied, they take them out, as well as the cisterns, to scrape off what glass remains, which otherwise would grow green by continuance of fire, and spoil the glasses. They are not filled again in less than 36 hours; so that they put the matter into the furnace, and begin to run it every 54 hours.

The manner of heating the large furnaces is very singular; the two tisors, or persons employed for that purpose, in their shirts, run swiftly round the furnace without making the least stop: as they run along, they take two billets, or pieces of wood, which are cut for the purpose: these they throw into the first tissart; and continuing their course, do the same for the second. This they hold without interruption for six hours successively; after which they are relieved by others, &c. It is surprising that two such small pieces of wood, and which are consumed in an instant, should keep the furnace to the proper degree of heat; which is such that a large bar of iron, laid at one of the mouths of the furnace, becomes red hot in less than half a minute.

The glass, when taken out of the melting furnace, needs nothing farther but to be ground, polished, and foliated.

4. *Grinding and Polishing of Plate* GLASS. Glass is made transparent by fire; but it receives its lustre by the skill and labour of the grinder and polisher; the former of whom takes it rough out of the hands of the maker.

In order to grind plate glass, they lay it horizontally upon a flat stone table made of a very fine grained freestone; and for its greater security they plaster it down with lime or stucco; for otherwise the force of the workmen, or the motion of the wheel with which they grind it, would move it about.

This stone table is supported by a strong frame A, made of wood, with a ledge quite round its edges, rising about two inches higher than the glass. Upon this glass to be ground is laid another rough glass not above half so big, and so loose as to slide upon it; but cemented to a wooden plank, to guard it from the injury it must otherwise receive from the scraping of the wheel to which this plank is fastened, and from the weights laid upon it to promote the grinding or triture of the glasses. The whole is covered with a wheel B, made

Plate CCXLVII. fig. 3.

FURNACE FOR ARTIFICIAL GEMS.

Fig. 6.

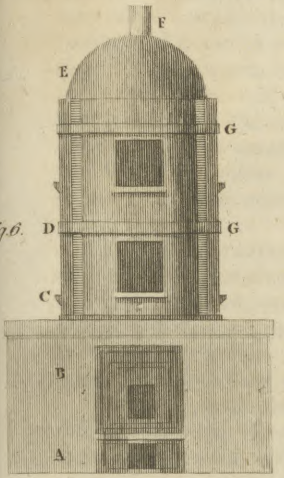


Fig. 5.

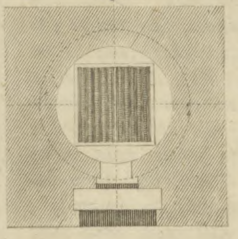
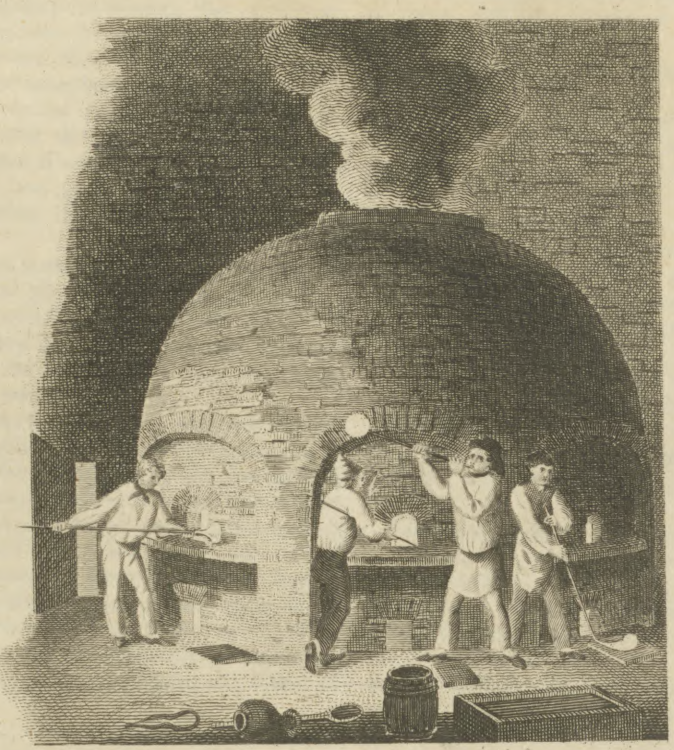


Fig 1 BLOWING.



FURNACE FOR ARTIFICIAL GEMS.

Fig. 7.

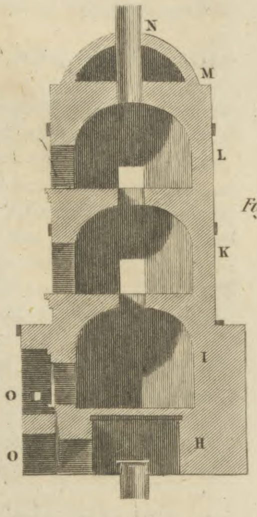


Fig. 4.

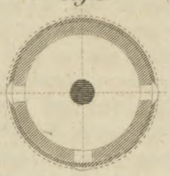


Fig. 3. POLISHING.

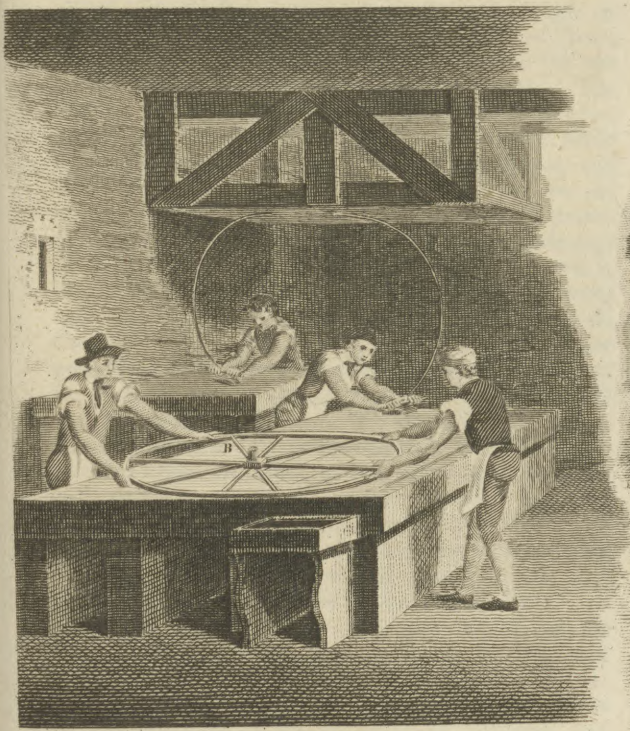
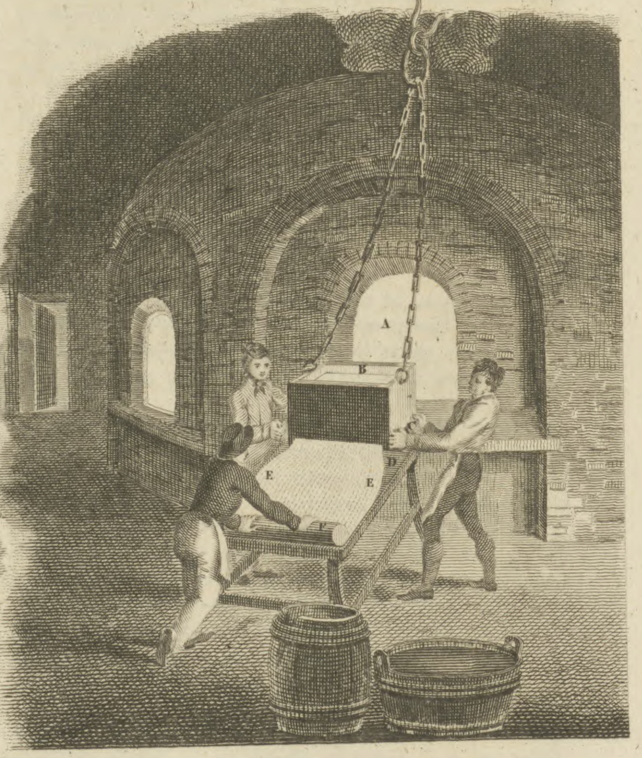


Fig. 2. CASTING.



Drawn & Engraved by

W. & D. Lizars Edinburgh.

made of hard light wood, about six inches in diameter, by pulling of which backwards and forwards alternately, and sometimes turning it round, the workmen, who always stand opposite to each other, produce a constant attrition between the two glasses, and bring them to what degree of smoothness they please, by first pouring in water and coarse sand; after that, a finer sort of sand, as the work advanceth, till at last they must pour in the powder of smalt. As the upper or incumbent glass polishes and grows smoother, it must be taken away, and another from time to time put in its place.

This engine is called a *mill* by the artist, and is used only in the largest sized glasses; for in the grinding of the lesser glasses, they are content to work without a wheel, and to have only four wooden handles fastened to the four corners of the stone which loads the upper plank, by which they work it about.

When the grinder has done his part, who finds it very difficult to bring the glass to an exact plainness, it is turned over to the polisher; who, with the fine powder of tripoli stone or emery, brings it to a perfect evenness and lustre. The instrument made use of in this branch is a board, *c c*, furnished with a felt, and a small roller, which the workman moves by means of a double handle at both ends. The artist, in working this roller, is assisted with a wooden hoop or spring, to the end of which it is fixed: for the spring, by constantly bringing the roller back to the same points, facilitates the action of the workman's arm.

Colouring of GLASS. That the colours given to glass may have their full beauty, it must be observed, that every pot when new, and first used, leaves a foulness in the glass from its own earthy parts; so that a coloured glass made in a new pot can never be bright or perfectly fine. For this reason, the larger of these, when new, may be glazed with white glass; but the second time of using the pots lose this foulness. The glazing may be done by reducing the glass to powder, and moistening the inside of the pot with water; while it is yet moist, put in some of the powdered glass, and shake it about, till the whole inner surface of the pot be covered by as much as will adhere to it, in consequence of the moisture. Throw out the redundant part of the powdered glass; and the pot being dry, set it in a furnace sufficiently hot to vitrify the glass adhering to it, and let it continue there some time; after which, care must be taken to let it cool gradually. Those pots which have served for one colour must not be used for another; for the remainder of the old matter will spoil the colour of the new. The colours must be very carefully calcined to a proper degree; for if they were calcined ether too much or too little, they never do well; the proper proportion, as to quantity, must also carefully be regarded, and the furnaces must be fed with dry hard wood. And all the processes succeed much the better if the colour be used dividedly, that is, part of it in the frit, and the rest in the melted meltal.

A hard glass, proper for receiving colours, may be prepared by pulverizing 12 pounds of the best sand cleansed by washing in a glass or flint mortar, and mixing seven pounds of pearl ashes or any fixed alkaline salt purified with nitre, one pound of saltpetre, and half a pound of borax, and pounding them together. A glass less hard may be prepared of twelve pounds of white sand cleansed, seven pounds of pearl ashes purified with saltpetre, one pound of nitre, half a pound of borax, and four ounces of arsenic prepared as before.

Amethyst colour. See *Purple* below, and the article AMETHYST.

Balas colour. Put into a pot crystal frit, thrice washed in water; tinge this with manganese, prepared into a clear purple; to this add *alumen cativum*, sifted fine, in small quantities, and at several times: this will make the glass grow yellowish, and a little reddish, but not blackish, and always dissipates the manganese. The last time you add manganese give no more of the *alumen cativum*, unless the colour be too full. Thus will the glass be exactly of the colour of the balas ruby. See *Ruby* GLASS.

The common black colour. The glassmakers take old broken glass of different colours, grind it to powder, and add to it, by different parcels, a sufficient quantity of a mixture of two parts zaffer and one part manganese: when well purified, they work it into vessels, &c.

Glass beads are coloured with manganese only.

Black velvet colour. To give this deep and fine colour to glass, take of crystalline and pulverine frit, of each 20 pounds; of calx of lead and tin, four pounds; set all together in a pot in the furnace, well heated: when the glass is formed and pure, take steel well calcined and powdered, scales of iron that fly off from the smith's anvil, of each an equal quantity; powder and mix them well; then put six ounces of this powder to the above-described metal while in fusion: mix the whole thoroughly together, and let them all boil strongly together; then let it stand in fusion 12 hours to purify, and after this work it. It will be a most elegant velvet black.

There is another way of doing this, which also produces a very fair black. It is this: take a hundred weight of rochetta frit, add to this two pounds of tartar and six pounds of manganese, both in fine powder; mix them well; and put them to the metal while in fusion, at different times, in several parcels; let it stand in fusion after this for four days, and then work it.

A glass perfectly black may also be formed by adding to ten pounds of either of the compositions for hard glass above described, one ounce of zaffer, six drachms of manganese, and an equal quantity of iron strongly calcined.

Blue colour. A full blue may be made by adding six drachms of zaffer and two drachms of manganese to ten pounds of either of the compositions for hard glass, described above. For a very cool or pure blue glass, half an ounce of calcined copper may be used instead of the manganese, and the proportion of zaffer diminished by one half. Glass resembling sapphire may be made with ten pounds of either of the compositions for hard glass, three drachms and one scruple of zaffer, and one drachm of the *calx cassii* or precipitation of gold by tin; or, instead of this latter ingredient, two drachms and two scruples of mangauese. Or a sapphire-coloured glass may be made by mixing with any quantity of the hard glass one-eighth of its weight of smalt. A beautiful blue glass is also produced from the oxide of cobalt.

Venetian brown, with gold spangles, commonly called the

the *philosopher's stone*, may be prepared in the following manner: take of the second composition for hard glass above described, and of the composition for paste, of each five pounds, and of highly calcined iron an ounce; mix them well, and fuse them till the iron be perfectly vitrified, and has tinged the glass of a deep transparent yellow brown colour. Powder this glass, and add to it two pounds of powdered glass of antimony; grind them together, and thus mix them well. Take part of this mixture, and rub into it 80 or 100 leaves of the counterfeit leaf gold called *Dutch gold;* and when the parts of the gold seem sufficiently divided, mix the powder containing it with the other part of the glass. Fuse the whole with a moderate heat till the powder run into a vitreous mass, fit to be wrought into any of the figures or vessels into which it is usually formed; but avoid a perfect liquefaction, because that in a short time destroys the equal diffusion of the spangles, and vitrifies, at least in part, the matter of which they are composed; converting the whole into a kind of transparent olive-coloured glass. This kind of glass is used for a great variety of toys and ornaments with us, who at present procure it from the Venetians.

Chalcedony. A mixture of several ingredients with the common matter of glass, will make it represent the semi-opake gems, the jaspers, agates, chalcedonies, &c. The way of making these seems to be the same with the method of making marbled paper, by several colours dissolved in several liquors, which are such as will not readily mix with one another when put into water, before they are cast upon the paper which is to be coloured. There are several ways of making these variously coloured glasses, but the best is the following.

Dissolve four ounces of fine leaf silver in a glass vessel in strong aquafortis; stop up the vessel, and set it aside.—In another vessel, dissolve five ounces of quicksilver in a pound of aquafortis, and set this aside.—In another glass vessel, dissolve in a pound of aquafortis three ounces of fine silver, first calcined in this manner: amalgamate the silver with mercury, mix the amalgam with twice its weight of common salt well purified; put the mixture in an open fire in a crucible, that the mercury may fly off, and the silver be left in form of powder. Mix this powder with an equal quantity of common salt well purified, and calcine this for six hours in a strong fire; when cold, wash off the salt by repeated boilings in common water, and then put the silver into the aquafortis. Set this solution also aside.—In another vessel, dissolve in a pound of aquafortis three ounces of sal ammoniac; pour off the solution and dissolve in it a quarter of an ounce of gold. Set this also aside.—In another vessel, dissolve three ounces of sal ammoniac in a pound of aquafortis; then put into the solution cinnabar, crocus martis, ultramarine, and ferretto of Spain, of each half an ounce. Set this also aside.—In another vessel, dissolve in a pound of aquafortis three ounces of sal ammoniac; then put into it crocus martis made with vinegar, calcined tin, zaffer, and cinnabar, of each half an ounce; let each of these be powdered very fine, and put gently into the aquafortis. Set this also aside.—In another vessel, dissolve three ounces of sal ammoniac in a pound of aquafortis, and add to it brass calcined with brimstone, brass thrice calcined, manganese, and scales of iron which fall from the smith's anvil, of each half an ounce; let each be well powdered, and put gently into the vessel. Then set this also aside.—In another vessel, dissolve two ounces of sal ammoniac in a pound of aquafortis, and put to it verdigrise an ounce, red lead, crude antimony, and the caput mortuum of vitriol, of each half an ounce; put these well powdered leisurely into the vessel, and set this also aside.—In another vessel, dissolve two ounces of sal ammoniac in a pound of aquafortis, and add orpiment, white arsenic, painters lake, of each half an ounce.

Keep the above nine vessels in a moderate heat for 15 days, shaking them well at times. After this pour all the matters from these vessels into one large vessel, well luted at its bottom; let this stand six days, shaking it at times; and then set it in a very gentle heat, and evaporate all the liquor, and there will remain a powder of a purplish green.

When this is to be wrought, put into a pot very clear metal, made of broken crystalline and white glass that has been used; for with the virgin frit, or such as has never been wrought, the chalcedony can never be made, as the colours do not stick to it, but are consumed by the frit. To every pot of 20 pounds of this metal put two or three ounces of this powder at three several times; incorporate the powder well with the glass; and let it remain an hour between each time of putting in the powders. After all are in, let it stand 26 hours; then let the glass be well mixed, and take an essay of it, which will be found of a yellowish blue; return this many times into the furnace; when it begins to grow cold, it will show many waves of different colours very beautifully. Then take tartar eight ounces, soot of the chimney two ounces, crocus martis made with brimstone, half an ounce; let these be well powdered and mixed, and put them by degrees into the glass at six times, waiting a little while between each putting in. When the whole is put in, let the glass boil and settle for 24 hours; then make a little glass body of it; which put in the furnace many times, and see if the glass be enough, and whether it have on the outside veins of blue, green, red, yellow, and other colours, and have, beside these veins, waves like those of the chalcedonies, jaspers, and oriental agates, and if the body kept within looks as red as fire.

When it is found to answer this, it is perfect, and may be worked into toys and vessels, which will always be beautifully variegated; these must be well annealed, which adds much to the beauty of their veins. Masses of this may be polished at the lapidary's wheel as natural stones, and appear very beautiful. If in the working the matter grow transparent, the work must be stopped, and more tartar, soot, and crocus martis, must be put to it, which will give it again the necessary body and opacity, without which it does not show the colours well.

Chrysolite colour may be made of ten pounds of either of the compositions for hard glass described above, and six drachms of calcined iron.

Red cornelian colour may be formed by adding one pound of glass of antimony, two ounces of the calcined vitriol called *scarlet ochre,* and one drachm of manganese or magnesia, to two pounds of either of the compositions

positions for hard glass. The glass of antimony and magnesia are first fused with the other glass, and then powdered and ground with the scarlet ochre: the whole mixture is afterwards fused with a gentle heat till all the ingredients are incorporated. A glass resembling the white cornelian may be made of two pounds of either of the compositions for hard glass, and two drachms of yellow ochre well washed, and one ounce of calcined bones: grind them together, and fuse them with a gentle heat.

Emerald colour. See *Green* below.

Garnet colour. To give this colour to glass, the workmen take the following method. They take equal quantities of crystal and rochetta frit, and to every hundred weight of this mixture they add a pound of manganese and an ounce of prepared zaffer: these are to be powdered separately, then mixed and added by degrees to the frit while in the furnace. Great care is to be taken to mix the manganese and zaffer very perfectly; and when the matter has stood 24 hours in fusion, it may be worked.

Glass of this kind may be made by adding one pound of glass of antimony, one drachm of manganese, and the same quantity of the precipitate of gold by tin, to two pounds of either of the compositions for hard glass; or the precipitate of gold may be omitted, if the quantities of the glass of antimony and manganese be doubled.

Gold colour. This colour may be produced by taking ten pounds of either of the compositions for hard glass, omitting the saltpetre; and for every pound adding an ounce of calcined borax, or, if this quantity doth not render the glass sufficiently fusible, two ounces; ten ounces of red tartar of the deepest colour; two ounces of magnesia; and two drachms of charcoal of sallow, or any other soft kind. Precipitates of silver baked on glass will stain it yellow, and likewise give it a yellow colour on being mixed and melted with 40 or 50 times their weight of vitreous compositions; the precipitate from aquafortis by fixed alkali seems to answer best. Yellow glasses may also be obtained with certain preparations of iron, particularly with Prussian blue. But Dr Lewis observes, that the colour does not constantly succeed, nor approach to the high colour of gold, with silver or with iron. The nearest imitations of gold which he has been able to produce have been effected with antimony and lead. Equal parts of the glass of antimony, of flint calcined and powdered, and of minium, formed a glass of a high yellow; and with two parts of glass of antimony, two of minium, and three of powdered flint, the colour approached still more to that of gold. The last composition exhibited a multitude of small sparkles interspersed throughout its whole substance, which gave it a beautiful appearance in the mass, but were really imperfections, owing to air bubbles.

Neri directs, for a gold yellow colour, one part of red tartar and the same quantity of manganese, to be mixed with a hundred parts of frit. But Kunckel observes, that these proportions are faulty; that one part, or one and a quarter, of manganese, is sufficient for a hundred of frit; but that six parts of tartar are hardly enough, unless the tartar is of a dark red colour, almost blackish; and that he found it expedient to add to the tartar about a fourth of its weight of powdered charcoal. He adds, that the glass swells up very much in melting, and that it must be left unstirred, and worked as it stands in fusion. Mr Samuel More, in repeating and varying this process in order to render the colour more perfect, found that the manganese is entirely unessential to the gold colour; and that the tartar is no otherwise of use than in virtue of the coaly matter to which it is in part reduced by the fire, the phlogiston or inflammable part of the coal appearing in several experiments to be the direct tinging substance. Mr Pott also observes, that common coals give a yellow colour to glass; that different coaly matters differ in their tinging power; that caput mortuum of soot and lamp black answer better than common charcoal: and that the sparkling coal, which remains in the retort after the rectification of the thick empyreumatic animal oils, is one of the most active of these preparations. This preparation, he says, powdered, and then burnt again a little in a close vessel, is excellent for tinging glass, and gives yellow, brown, reddish, or blackish colours, according to its quantity; but the frit must not be very hard of fusion, for in this case the strong fire will destroy the colouring substance before the glass melts: and he has found the following composition to be nearly the best; viz. sand two parts, alkali three parts; or sand two, alkali three, calcined borax one; or sand two, alkali two, calcined borax one: and though saltpetre is hardly used at all, or very sparingly, for yellow glasses, as it too much volatilizes the colouring substance; yet here for the most part a certain proportion of it, easily determined by trial, is very necessary; for without it the concentrated colouring matter is apt to make the glass too dark, and even of an opake pitchy blackness. It does not certainly appear that there is any material diversity in the effects of different coals, the difference being probably owing to the different quantities of the inflammable matter which they contain; so that a little more shall be required of one kind than of another for producing the same degree of colour in the glass. Nor does the softness or fusibility of the frit appear to be in any respect necessary.

Gold-coloured spangles may be diffused through the substance of glass, by mixing the yellow talcs with powdered glass, and bringing the mixture into fusion.

Green. This colour may be imparted to glass by adding three ounces of copper precipitated from aquafortis, and two drachms of precipitated iron, to nine pounds of either of the compositions for hard glass. The finest method of giving this beautiful colour to glass is this: Take five pounds of crystalline metal that has been passed several times through water, and the same quantity of the common white metal of polverine, four pounds of common polverine frit, and three pounds of red lead; mix the red lead well with the frit, and then put all into a pot in a furnace. In a few hours the whole mass will be well purified: then cast the whole into water, and separate and take out the lead; then return the metal into the pot, and let it stand a day longer in fusion; then put in the powder of the residuum of the vitriol of copper, and a very little crocus martis, there will be produced a most lively and elegant green, scarce inferior to that of the oriental emerald. There are many ways of giving a green to glass, but all are greatly inferior to this.—To make a *sea green*, the finest crystalline glass only must be used, and no manganese must

Glass. must be added at first to the metal. The crystal frit must be melted thus alone; and the salt, which swims like oil on its top, must be taken off with an iron ladle very carefully. Then to a pot of twenty pounds of this metal add six ounces of calcined brass, and a fourth part of the quantity of powdered zaffer: this powder must be well mixed, and put into the glass at three times; it will make the metal swell at first, and all must be thoroughly mixed in the pot. After it has stood in fusion three hours, take out a little for a proof: if it be too pale, add more of the powder. Twenty-four hours after the mixing the powder the whole will be ready to work; but must be well stirred together from the bottom, lest the colour should be deepest there, and the metal at the top less coloured, or even quite colourless. Some use for this purpose half crystal frit and half rochetta frit, but the colour is much the finest when all crystal frit is used.

Lapis lazuli colour. See *Lapis* LAZULI.

Opal colour. See OPAL.

Purple of a deep and bright colour may be produced by adding to ten pounds of either of the compositions for hard glass, above described, six drachms of zaffer and one drachm of gold precipitated by tin; or to the same quantity of either composition one ounce of manganese and half an ounce of zaffer. The colour of amethyst may be imitated in this way.

Red. A blood-red glass may be made in the following manner: Put six pounds of glass of lead, and ten pounds of common glass, into a pot glazed with white glass. When the whole is boiled and refined, add by small quantities, and at small distances of time, copper calcined to a redness as much as on repeated proofs is found sufficient: then add tartar in powder by small quantities at a time, till the glass is become as red as blood; and continue adding one or other of the ingredients till the colour is quite perfect.

Ruby. The way to give the true fine red of the ruby, with a fair transparence, to glass, is as follows: Calcine in earthen vessels gold dissolved in aqua-regia; the menstruum being evaporated by distillation, more aqua regia added, and the abstraction repeated five or six times, till it becomes a red powder. This operation will require many days in a hot furnace. When the powder is of a proper colour, take it out: and when it is to be used, melt the finest crystal glass, and purify it by often casting it into water; and then add, by small quantities, enough of this red powder to give it the true colour of a ruby, with an elegant and perfect transparence.

The process of tinging glass and enamels by preparations of gold was first attempted about the beginning of the last century. Libavius, in one of his tracts entitled *Alchymia*, printed in 1606, conjectures that the colour of the ruby proceeds from gold, and that gold dissolved and brought to redness might be made to communicate a like colour to factitious gems and glass. On this principle Neri, in his Art of Glass, dated in 1611, gives the process above recited. Glauber in 1648 published a method of producing a red colour by gold, in a matter which is of the vitreous kind, though not perfect glass. For this purpose he ground powdered flint or sand with four times its weight of fixed alkaline salt: this mixture melts in a moderately strong fire, and when cool looks like glass, but exposed to the air runs into a liquid state. On adding this liquor to solution of gold in aqua-regia, the gold and flint precipitate together in form of a yellow powder, which by calcination becomes purple. By mixing this powder with three or four times its weight of the alkaline solution of flint, drying the mixture, and melting it in a strong fire for an hour, a mass is obtained of a transparent ruby colour and of a vitreous appearance; which nevertheless is soluble in water, or by the moisture of the air, on account of the redundance of the salt. The Honourable Mr Boyle, in a work published in 1680, mentions an experiment in which a like colour was introduced into glass without fusion; for having kept a mixture of gold and mercury in digestion for some months, the fire was at last immoderately increased, so that the glass burst with a violent explosion; and the lower part of the glass was found tinged throughout of a transparent red colour, hardly to be equalled by that of rubies.

About the same time Cassius is said to have discovered the precipitation of gold by tin, and that glass might be tinged of a ruby colour by melting it with this precipitate; though he does not appear, says Dr Lewis, from his treatise *De Auro*, to have been the discoverer of either. He describes the preparation of the precipitate and its use; but gives no account of the manner of employing it, only that he says one drachm of gold duly prepared will tinge ten pounds of glass.

Commerce of Arts, p. 171. 621. &c.

This process was soon after brought to perfection by Kunckel; who says, that one part of the precipitate is sufficient to give a ruby colour to 1280 parts of glass, and a sensible redness to upwards of 1900 parts; but that the success is by no means constant. Kunckel also mentions a purple gold powder, resembling that of Neri; which he obtained by inspissating solution of gold to dryness; abstracting from it fresh aqua-regia three or four times, till the matter appears like oil; then precipitating with strong alkaline ley, and washing the precipitate with water. By dissolving this powder in spirit of salt and precipitating again, it becomes, he says, extremely fair; and in this state he directs it to be mixed with a due proportion of Venice glass.

Orschal, in a treatise entitled *Sol sine Veste*, gives the following process for producing a very fine ruby. He directs the purple precipitate made by tin to be ground with six times its quantity of Venice glass into a very fine powder, and this compound to be very carefully mingled with the frit or vitreous composition to be tinged. His frit consists of equal parts of borax, nitre, and fixed alkaline salt, and four times as much calcined flint as of each of the salts; but he gives no directions as to the proportion of the gold precipitate or mode of fusion. Hellot describes a preparation, which, mixed with Venice glass, was found to give a beautiful purple enamel. This preparation consists of equal parts of solution of gold and of solution of zinc in aqua-regia mixed together, with the addition of a volatile salt prepared from sal ammoniac by quicklime, in sufficient quantity to precipitate the two metals. The precipitate is then gradually heated till it acquires a violet colour. However, though a purple or red colour, approaching to that of ruby, may, by the methods above recited, be baked on glass or enamels, and introduced into the mass by fusion, the way of equally diffusing such

such a colour through a quantity of fluid glass is still, says Dr Lewis, a secret. The following process for making the ruby glass was communicated to Dr Lewis by an artist, who ascribed it to Kunckel. The gold is directed to be dissolved in a mixture of one part of spirit of salt and three of aquafortis, and the tin in a mixture of one part of the former of these acids with two of the latter. The solution of gold being properly diluted with water, the solution of tin is added, and the mixture left to stand till the purple matter has settled to the bottom. The colourless liquor is then poured off, and the purple sediment, while moist and not very thick, is thoroughly mixed with powdered flint or sand. This mixture is well ground with powdered nitre, tartar, borax, and arsenic, and the compound melted with a suitable fire. The proportions of the ingredients are 2560 parts of sand, 384 of nitre, 240 of tartar, 240 of borax, 28 of arsenic, five of tin, and five of gold.

Topas Colour. Glass resembling this stone may be made by pulverizing ten pounds of either of the compositions for hard glasses with an equal quantity of the gold-coloured glass, and fusing them together.

White opake and *semitransparent* glass may be made of ten pounds of either of the compositions for hard glass, and one pound of well calcined horn, ivory, or bone; or an opake whiteness may be given to glass by adding one pound of very white arsenic to ten pounds of flint glass. Let them be well powdered and mixed by grinding them together, and then fused with a moderate heat till they are thoroughly incorporated. A glass of this kind is made in large quantities at a manufactory near London; and used not only for different kinds of vessels, but as a white ground for enamel in dial plates and snuff boxes, which do not require finishing with much fire, because it becomes very white and fusible with a moderate heat.

Yellow. See *Gold colour* above.

Painting in Glass. The ancient manner of painting in glass was very simple: it consisted in the mere arrangement of pieces of glass of different colours in some sort of symmetry, and constituted what is now called *mosaic work*. See Mosaic.

In process of time they came to attempt more regular designs, and also to represent figures heightened with all their shades; yet they proceeded no farther than the contours of the figures in black with water colours, and hatching the draperies after the same manner on glasses of the colour of the object they designed to paint. For the carnation, they used glass of a bright red colour; and upon this they drew the principal lineament of the face, &c. with black.

At length, the taste for this kind of painting improving considerably, and the art being found applicable to the adorning of churches, basilics, &c. they found out means of incorporating the colours in the glass itself, by heating them in the fire to a proper degree; having first laid on the colours. A French painter at Marseilles is said to have given the first notion of this improvement, upon going to Rome under the pontificate of Julius II.; but Albert Durer and Lucas of Leyden were the first that carried it to any height.

This art, however, has frequently met with much interruption, and sometimes been almost totally lost; of which Mr Walpole gives us the following account, in his Anecdotes of Painting in England.

"The first interruption given to it was by the reformation, which banished the art out of churches; yet it was in some measure kept up in the escutcheons of the nobility and gentry in the windows of their seats. Towards the end of Queen Elizabeth's reign it was omitted even there; yet the practice did not entirely cease. The chapel of our Lady at Warwick was ornamented anew by Robert Dudley earl of Leicester, and his countess, and the cipher of the glass-painter's name yet remains, with the date 1574: and in some of the chapels at Oxford the art again appears, dating itself in 1622, by the hand of no contemptible master.

"I could supply even this gap of 48 years by many dates on Flemish glass; but no body ever supposed that the secret was lost so early as the reign of James I. and that it has not perished since will be evident from the following series, reaching to the present hour.

"The portraits in the windows of the library at All Souls, Oxford. In the chapel at Queen's College there are twelve windows dated 1518. P. C. a cipher on the painted glass in the chapel at Warwick, 1574. The windows at Wadham's College; the drawing pretty good, and the colours fine, by Bernard Van Linge, 1622. In the chapel at Lincoln's Inn, a window, with the name Bernard, 1623. This was probably the preceding Van Linge. In the church of St Leonard, Shoreditch, two windows by Baptista Sutton, 1634. The windows in the chapel at University College, Hen. Giles *pinxit*, 1687. At Christ Church, Isaac Oliver, aged 84, 1700. Window in Merton Chapel, William Price 1700. Windows at Queen's New College, and Maunlin, by William Price, the son, now living, whose colours are fine, whose drawing is good, and whose taste in ornaments and mosaic is far superior to any of his predecessors; is equal to the antique, to the good Italian masters, and only surpassed by his own singular modesty.

"It may not be unwelcome to the curious reader to see some anecdotes of the revival of taste for painted glass in England. Price, as we have said, was the only painter in that style for many years in England. Afterwards one Rowell, a plumber at Reading, did some things, particularly for the late Henry earl of Pembroke; but Rowell's colours soon vanished. At last he found out a very durable and beautiful red; but he died in a year or two, and the secret with him. A man at Birmingham began the same art in 1756 or 1757, and fitted up a window for Lord Lyttleton, in the church of Hagley; but soon broke. A little after him, one Peckitt at York began the same business, and has made good proficiency. A few lovers of that art collected some dispersed panes from ancient buildings, particularly the late Lord Cobham, who erected a Gothic temple at Stowe, and filled it with arms of the old nobility, &c. About the year 1753, one Asciotti, an Italian, who had married a Flemish woman, brought a parcel of painted glass from Flanders, and sold it for a few guineas to the Honourable Mr Batemen, of Old Windsor. Upon that I sent Asciotti again to Flanders, who brought me 450 pieces, for which, including the expence of his journey, I paid him thirty-six guineas. His wife made more journeys for the same pur-

pose;

pose; and sold her cargo to one Palmer a glazier in St Martin's lane, who immediately raised the price to one, two, or five guineas for a single piece, and fitted up entire windows with them, and with mosaics of plain glass of different colours. In 1761, Paterson, an auctioneer at Essex house in the Strand, exhibited the two first auctions of painted glass, imported in like manner from Flanders. All this manufacture consisted in rounds of Scripture stories, stained in black and yellow, or in small figures of black and white; birds and flowers in colours, and Flemish coats of arms.

The colours used in painting or staining of glass are very different from those used in painting either in water or oil colours.

For black, take scales of iron, one ounce; scales of copper, one ounce; jet, half an ounce: reduce them to powder, and mix them. For blue, take powder of blue, one pound; sal nitre, half a pound: mix them and grind them well together. For carnation, take red chalk, eight ounces; iron scales, and litharge of silver, of each two ounces; gum arabic, half an ounce; dissolve in water: grind all together for half an hour as stiff as you can; then put it in a glass and stir it well, and let it stand to settle 14 days. For green, take red lead one pound; scales of copper, one pound; and flint, five pounds: divide them into three parts; and add to them as much sal nitre; put them into a crucible, and melt them with a strong fire; and when it is cold, powder it, and grind it on a porphyry. For gold colour, take silver, an ounce; antimony, half an ounce: melt them in a crucible; then pound the mass to powder, and grind it on a copper plate; add to it yellow ochre, or brick dust calcined again, 15 ounces; and grind them well together with water. For purple, take minium, one pound; brown stone, one pound; white flint, five pounds: divide them into three parts, and add to them as much sal nitre as one of the parts; calcine, melt, and grind as you did the green. For red, take jet, four ounces; litharge of silver, two ounces; red chalk, one ounce: powder them fine, and mix them. For white, take jet, two parts; white flint, ground on a glass very fine, one part: mix them. For yellow, take Spanish brown, ten parts; leaf silver, one part; antimony, half a part: put all into a crucible, and calcine them well.

In the windows of ancient churches, &c. there are to be seen the most beautiful and vivid colours imaginable, which far exceed any of those used by the moderns, not so much because the secret of making those colours is entirely lost, as that the moderns will not go to the charge of them, nor be at the necessary pains, by reason that this sort of painting is not now so much in esteem as formerly. Those beautiful works which were made in the glass houses were of two kinds.

In some, the colour was diffused through the whole substance of the glass. In others, which were the more common, the colour was only on one side, scarce penetrating within the substance above one-third of a line; though this was more or less according to the nature of the colour, the yellow being always found to enter the deepest. These last, though not so strong and beautiful as the former, were of more advantage to the workmen, by reason that on the same glass, though already coloured, they could show other kinds of colours where there was occasion to embroider draperies, enrich them with foliages, or represent other ornaments of gold, silver, &c.

In order to this, they made use of emery, grinding or wearing down the surface of the glass till such time as they were got through the colour to the clear glass, This done, they applied the proper colours on the other side of the glass. By these means, the new colours were hindered from running and mixing with the former, when they exposed the glasses to the fire, as will appear hereafter.

When indeed the ornaments were to appear white, the glass was only bared of its colour with emery, without tinging the place with any colour at all; and this was the manner by which they wrought their light and heightenings on all kinds of colour.

The first thing to be done, in order to paint or stain glass, in the modern way, is to design, and even colour, the whole subject on paper. Then they choose such pieces of glass as are clear, even, and smooth, and proper to receive the several parts; and proceed to distribute the design itself, or papers it is drawn on, into pieces suitable to those of the glass; always taking care that the glasses may join in the contours of the figures and the folds of the draperies; that the carnations, and other finer parts, may not be impaired by the lead with which the pieces are to be joined together. The distribution being made, they mark all the glasses as well as papers, that they may be known again: which done, applying every part of the design upon the glass intended for it, they copy or transfer the design upon this glass with the black colour diluted in gum water, by tracing and following all the lines and strokes as they appear through the glass with the point of a pencil.

When these strokes are well dried, which will happen in about two days, the work being only in black and white, they give a slight wash over with urine, gum arabic, and a little black; and repeat it several times, according as the shades are desired to be heightened; with this precaution, never to apply a new wash till the former is sufficiently dried.

This done, the lights and risings are given by rubbing off the colour in their respective places with a wooden point, or the handle of the pencil.

As to the other colours above mentioned they are used with gum water, much as in painting in miniature; taking care to apply them lightly, for fear of effacing the outlines of the design; or even, for the greater security, to apply them on the other side; especially yellow, which is very pernicious to the other colours, by blending therewith. And here too, as in pieces of black and white, particular regard must always be had not to lay colour on colour, or lay on a new lay, till such time as the former are well dried.

It may be added that the yellow is the only colour that penetrates through the glass and incorporates therewith by the fire; the rest, and particularly the blue, which is very difficult to use, remaining on the surface, or at least entering very little. When the painting of all the pieces is finished, they are carried to the furnace or oven to anneal or bake the colours.

The furnace here used is small, built of brick, from 18 to 30 inches square. At six inches from the bottom is an aperture to put in the fuel and maintain the fire.

Glass. fire. Over this aperture is a grate made of three square bars of iron, which traverse the furnace, and divide it into two parts. Two inches above this partition is another little aperture, through which they take out pieces to examine how the coction goes forward. On the grate is placed a square earthen pan, six or seven inches deep, and five or six inches less every way than the perimeter of the furnace. On the other side hereof is a little aperture, through which to make trials, placed directly opposite to that of the furnaces destined for the same end. In this pan are the pieces of glass to be placed in the following manner: First, The bottom of the pan is covered with three strata or layers of quicklime pulverized; those strata being separated by two others of old broken glass, the design whereof is to secure the painted glass from the too intense heat of the fire. This done, the glasses are laid horizontally on the last or uppermost layer of lime.

The first row of glass they cover over with a layer of the same powder an inch deep; and over this they lay another range of glasses, and thus alternately till the pan is quite full; taking care that the whole heap always end with a layer of the lime powder.

The pan being thus prepared, they cover up the furnace with tiles, on a square table of earthen ware, closely luted all round; only leaving five little apertures, one at each corner, and another in the middle, to serve as chimneys. Things thus disposed, there remains nothing but to give the fire to the work. The fire for the first two hours must be very moderate, and must be increased in proportion as the coction advances, for the space of ten or twelve hours; in which time it is usually completed. At last the fire, which at first was charcoal, is to be of dry wood, so that the flame covers the whole pan, and even issues out at the chimneys.

During the last hours, they make essays, from time to time, by taking out pieces laid for the purpose through the little aperture of the furnace and pan, to see whether the yellow be perfect, and the other colours in good order. When the annealing is thought sufficient, they proceed with great haste to extinguish the fire, which otherwise would soon burn the colours, and break the glasses.

Glass Balls, which are circular, or otherwise shaped hollow vessels of glass, may be coloured within, so as to imitate the semipellucid gems. The method of doing it is this: make a strong solution of ichthyocolla, or isinglass, in common water, by boiling; pour a quantity of this while warm into the hollow of a white glass vessel; shake it thoroughly about, that all the sides may be wetted, and then pour off the rest of the moisture. Immediately after this, throw in red lead, shake it and turn it about, throw it into many places with a tube, and the moisture will make it stick and run in waves and pretty figures. Then throw in some of the painters blue smalt, and make it run in waves in the ball as the red lead; then do the same with verdigrise, next with orpiment, then with red lake, all well ground; always casting in the colours in different places, and turning the glass, that the moisture within may run them into the waves. Then take fine plaster of Paris, and put a quantity of it into the ball; shake it also nimbly about; this will everywhere stick firmly to the glass, and give it a strong inner coat, keeping all the colours on very fairly and strongly. These are set on frames of carved wood, and much esteemed as ornaments in many places. Glass.

Glass Drop. See *Rupert's Drops*.

Engraving on Glass. Professor Beckmann has proved, that so early as the year 1670 the art of etching upon glass was discovered by Henry Schwanhard, son of George Schwanhard, who was a celebrated glass-cutter, patronized by the emperor Ferdinand III. about the middle of the last century. At the time of his death, 1697, the father practised his art at Prague and Ratisbon. Whether the son followed the same business at the same towns, or removed to Nuremberg, is not very evident; but in the year above mentioned, some *aqua-regia* (nitro-muriatic acid) having accidentally fallen on his spectacles, he was surprised to find the glass corroded by it, and become quite soft. He thus, it is said, found himself in possession of a liquid by which he could etch writing and figures upon plates of glass.

But it is probable, as Beckmann seems to think, that he had discovered the fluoric acid itself; for in the year 1725 there appeared in a periodical work the following receipt for making a powerful acid, by which figures of every kind can be etched upon glass.

"When the *spiritus nitri per distillationem* has passed into the recipient, ply it with a strong fire, and when well dephlegmated, pour it, as it corrodes ordinary glass, into a Weldenberg flask. Then throw into it a pulverized green Bohemian emerald, otherwise called *hesphorus*, (which, when reduced to powder, and heated, emits in the dark a green light), and place it in warm sand for 24 hours. Take a piece of glass well cleaned, and freed from all grease by means of a ley; put a border of wax round it, about an inch in height, and cover it all over with the above acid. The longer you let it stand so much the better; and at the end of some time the glass will be corroded, and the figures which have been traced out with sulphur and varnish will appear as if raised above the pane of glass.

That the Bohemian emerald or *hesphorus* mentioned in this receipt it green sparry fluor, cannot, says the professor, be doubted; and he seems to have as little doubt of the receipt itself having passed from Schwanhard and his scholars to the periodical work of 1725, from which it was inserted in the Oekonomische Encyclopedie of Krunitz. This supposition certainly acquires a considerable degree of probability from the similarity of Schwanhard's method of etching to that which is here recommended, and which is so different from what is now followed. At present, the glass is covered with a varnish either of isinglass dissolved in water, or of turpentine oil mixed with a little white lead, through which the figures to be etched are traced as on copper; but Schwanhard, when he had drawn his figures, covered them with varnish, and then by his liquid corroded the glass around them. His figures, therefore, when the varnish was removed, remained smooth and clear, appearing raised from a dim or dark ground; and M. Beckmann who persuaded some ingenious artists to make trial of this ancient method of etching, declares, that such figures have a much better effect than those which are cut into the glass.

Foliating of Glass. See *Foliating and Looking-glass.*

Glass.

Gilding of Glass. See Gilding.

Impressions of antique Gems taken in Glass. See Gems.

Glass of Lead, a glass made with the addition of a large quantity of lead, of great use in the art of making counterfeit gems. The method of making it is this: Put a large quantity of lead into a potter's kiln, and keep it in a state of fusion with a moderate fire, till it is calcined to a gray loose powder; then spread it in the kiln, and give it a greater heat, continually stirring it to keep it from running into lumps; continue this several hours, till the powder become of a fair yellow; then take it out, and sift it fine: this is called *calcined lead*. Take of this calcined lead 45 pounds, and crystalline or other frit 12 pounds; mix these as well as possible together; put them into a pot, and set them in the furnace for ten hours; then cast the whole, which will be now perfectly melted, into water; separate the loose lead from it, and return the metal into the pot; and after standing in fusion 12 hours more, it will be fit to work. It is very tender and brittle, and must be worked with great care, taking it slowly out of the pot, and continually wetting the marble it is wrought upon.

It is well known that ceruse or white lead, minium, litharge, and all the other preparations and calces of lead, are easily fused by a moderate fire, and formed into a transparent glass of a deep yellow colour. But this glass is so penetrating and powerful a flux, that it is necessary to give it a greater consistence, in order to render it fit for use. With this view, two parts of calx of lead, *e. g.* minium, and one part of sand or powdered flints, may be put into a crucible of refractory clay, and baked into a compact body. Let this crucible, well closed with a luted lid, be placed in a melting furnace, and gradually heated for an hour, or an hour and a half; and afterwards let the heat be increased so as to obtain a complete fusion, and continued in that state for the same time: let the crucible remain to cool in the furnace; and when it is broken a very transparent yellow coloured glass will be found in it. Some add nitre and common salt to the above mixture, because these salts promote the fusion and the more equal distribution of the sand. This glass of lead has a considerable specific gravity, and its lowest part is always the heaviest. It is an important flux in the assays of ores to facilitate their scorification.

Glass of lead is capable of all the colours of the gems in very great perfection. The methods of giving them are these: for green, take pulverine frit 20 pounds, lead calcined 16 pounds; sift both the powders very fine; then melt them into a glass, separating the unmixed lead, by plunging the mass in water; after this return it into the pot, and add brass thrice calcined six ounces, and one pennyweight of crocus martis made with vinegar; put this in at six different times, always carefully mixing it together, and take a proof of it; when the colour is right, let it stand eight hours, and then work it. If instead of the calcined brass the same quantity of the caput mortuum of the vitriolum veneris be used, the green is yet much finer.

For topaz colour, take crystal frit 15 pounds, calcined lead 12 pounds; mix them well together, by sifting the powders through a fine sieve; then set them in a furnace not too hot, and separate the superfluous unmixed lead, by casting the whole into water; repeat this twice: then add half gold yellow glass, and let them incorporate and purify, and they will be of the true and exact colour of the oriental topazes.

For sea green, take crystal frit 16 pounds, calcined lead 10 pounds; mix and sift them together, and set them in a pot in a furnace; in 12 hours the whole will be melted; then cast it into water, and separate it from the loose lead; put them into the furnace again for eight hours; then separate the loose lead by washing a second time, and return it to the pot for eight hours more.

Muscovy Glass. See Mica, Mineralogy *Index*.

Painting on Glass by means of Prints. See *Back-painting*.

Glass Porcelain, the name given by many to a modern invention of imitating the china ware with glass. The method given by M. Reaumur, who was the first that carried the attempt to any degree of perfection, is shortly this: The glass vessels to be converted into porcelain are to be put into a large earthen vessel, such as the common fine earthen dishes are baked in, or into sufficiently large crucibles; the vessels are to be filled with a mixture of fine white sand, and of fine gypsum or plaster stone burnt into what is called plaster of Paris, and all the interstices are to be filled up with the same powder, so that the glass vessels may nowhere touch either one another, or the sides of the vessel they are baked in. The vessel is to be then covered down and luted, and the fire does the rest of the work; for this is only to be put into a common potter's furnace, and when it has stood there the usual time of the baking the other vessels, it is to be taken out, and the whole contents will be found no longer glass, but converted into a white opaque substance, which is a very elegant porcelain, and has almost the properties of that of China.

The powder which has served once will do again as well as fresh, and that for a great many times: nay, it seems, ever so often. The cause of this transformation, says Macquer, is probably that the vitriolic acid of the gypsum quits its basis of calcareous earth, and unites with the alkaline salt and saline earth of the glass, with which it forms a kind of salt, different from the calcareous selenite, by the interposition of which matter the glass acquires the qualities of porcelain.

Glass Pots, the vessels in the glass trade used for melting the glass. Those for the white glass works are made of a tobacco pipe clay, brought from the isle of Wight, which is first well washed, then calcined, and afterwards ground to a fine powder in a mill; which being mixed with water, is then trod with the bare feet till it is of a proper consistence to mould with the hands into the proper shape of the vessels. When these are thus made, they are afterwards annealed over the furnace. Those for the green glass works are made of the nonsuch, and another sort of clay from Staffordshire; they make these so large as to hold three or four hundred weight of metal. And besides these, they have a small sort called piling pots, which they set upon the larger, and which contain a finer and more nice metal fit for the nicest works.

The clay that is used for this purpose should be of the purest and most refractory kind, and well cleansed from all sandy, ferruginous, and pyritous matters; and to to this it will be proper to add ground crucibles, white sand, calcined flints duly levigated, or a certain proportion of the same clay baked, and pounded not very finely. The quantity of baked clay that ought to be mixed with the crude clay, to prevent the pots from cracking when dried, or exposed to a great heat, is not absolutely determined, but depends on the quality of the crude clay, which is more or less fat. M. D'Antic, in a memoir on this subject, proposes the following method of ascertaining it: The burnt and crude clay, being mixed in different proportions, should be formed into cakes, one inch thick, and four inches long and wide. Let these cakes be slowly dried, and exposed to a violent heat, till they become as hard and as much contracted as possible, and in this state be examined; and the cake, he says, which has suffered a diminution of its bulk equal only to an eighteenth part, is made of the best proportions. He observes, in general, that most clays require that the proportion of the burnt should be to the fresh as four to five.

Tin GLASS, the same with Bismuth. See BISMUTH, CHEMISTRY *Index*.

GLASSES are distinguished, with regard to their form, use, &c. into various kinds, as drinking glasses, optical glasses, looking glasses, burning glasses, &c.

Drinking GLASSES, are simple vessels of common glass or crystal, usually made in form of an inverted cone.

Each glass consists of three parts, viz. the bowl, the bottom, and the foot; which are all wrought or blown separately.

Nothing can be more dexterous and expeditious than the manner of blowing these parts: two of them opened, and all three joined together. An idea is only to be had thereof, by seeing it actually done. For the method of gilding the edges of drinking glasses, see GILDING *on Enamel and Glass*.

Optical GLASSES. See OPTICS.

The improvements hitherto made in telescopes by means of combining lenses made of different kinds of glass, though very great, are yet by no means adequate to the expectations that might reasonably be formed, if opticians could fall on any method of obtaining pieces of glass sufficiently large for pursuing the advantages of Mr Dollond's discovery. Unfortunately, however, though the board of longitude have offered a considerable reward for bringing this art to the requisite perfection, no attempt of any consequence has hitherto been made. Mr Keir is of opinion, that the accomplishment of this is by no means an easy task; as it requires not only a competent knowledge of the properties of glass fitted for the purpose (the faults not being evident to common inspection), but a considerable degree of chemical knowledge is also necessary in order to invent a composition by which these faults may be avoided; and lastly, a kind of dexterity in the execution of the work, which can only be acquired by practice. Our author, however, thinks, that if the subject were more generally understood, and the difficulties more fully pointed out, for which purpose he makes the following remarks, the end may be more easily accomplished.

1. The rays of light passing through a glass lens or prism, or through any other medium of unequal thickness, are refracted; but not in an equal manner, the blue, violet, &c. being more refracted than the red.

2. Hence it happens, that the rays of light, when refracted by a common lens, do not all unite in one focus, but in reality form as many different foci as there are colours; and hence arise the prismatic colours, or irises, which appear towards the borders of the image formed by the common convex lenses, and which render the vision extremely indistinct.

3. The indistinctness of vision produced by this cause, which is sensible in telescopes of a small aperture, increases in so great a proportion, viz. as the cubes of the diameters, that it seemed impossible to increase the power of dioptric telescopes greatly, without extending them to a very inconvenient length, unless this confusion of colours could be corrected.

4. It was known that different transparent bodies possessed different degrees of refractive power; and until Mr Dollond discovered the contrary, it was supposed, that the refractions of the coloured rays were always in a determined ratio to one another. On this supposition it seemed impossible to correct the faults of refracting telescopes: for it was supposed, that if the dispersion of light produced by a convex lens were counteracted by another lens or medium of a concave form, the refraction would be totally destroyed; and this indeed would be the case, if the two mediums were made of the same matter; and from some experiments made by Sir Isaac Newton, this was supposed to be actually the case in all substances whatever.

5. From considering that the eyes of animals are formed of mediums of different colours, it occurred first to Mr David Gregory, the celebrated professor of astronomy at Oxford, and then to Mr Euler, that, by a combination of mediums which had different refractive powers, it might be possible to remedy the imperfections of dioptric telescopes. It does not, however, appear, that either of these gentlemen understood the true principle on which these phenomena depend. Mr Euler executed his idea by forming a compound object lens from two glass lenses with water interposed, but his attempt was not attended with success. Mr Dollond, however, was led by some arguments adduced by Mr Klingenstierna of Sweden, to repeat one of Sir Isaac Newton's experiments, and which had induced even that great philosopher himself to suppose that the improvement afterwards executed by Mr Dollond was impossible. This experiment was made by Sir Isaac Newton, by placing a glass prism within a prismatic vessel filled with water, in such a manner that the rays of light which were refracted by the glass prism should pass through and be refracted in a contrary direction by the water prism. In this manner the refraction of the light was entirely destroyed. But when Mr Dollond repeated the experiment, he found, that, contrary to his own expectations, when the angles of the two prisms were so proportioned that they counteracted each other's mean refraction, then colours appeared; and on the other hand, when they were so proportioned that the dispersion of the coloured rays was counteracted, the mean refraction still subsisted; which evidently proved, that the mean refractive and dispersive powers of glass and water were not proportional to one another.

6. To apply this to the proposed improvement, Mr Dollond examined several kinds of glass. Crown glass was found to possess the smallest dispersive power in proportion to its refraction; while flint glass possessed the

the greatest dispersive power in proportion to its refraction, which was also very great. On comparing these two exactly together, he found, that a wedge of white flint glass whose angle was about 25 degrees, and another of crown glass whose angle was 29 degrees, refracted very nearly alike. He found also, that, when the wedges were ground to such angles, the refraction produced by the flint glass was to that produced by the crown glass nearly as two to three; the refracted light was then free from colour. On measuring the general refracting powers of these two glasses, he found, that in flint glass, the sine of incidence of the rays was to the sine of mean refraction as 1 to 1.583; and that in crown glass, the sine of incidence was to the sine of mean refraction as 1 to 1.53.

The methods of determining the different refractive powers of glass are given under the the article OPTICS. Here we shall only observe, that two kinds of glass are necessary for the construction of achromatic telescopes; one of which shall possess as small, and the other as great, dispersive powers, relative to their mean refracting powers, as can be produced. The difference of glasses in this respect depends on the quality of the ingredients employed in their composition. Crown glass, which is composed of sand melted by means of the ashes of sea weeds, barilla or kelp, both which fluxes are known to consist of vegetable earth, alkali, and neutral salt, is found to give the smallest dispersive power. Plate glass, which consists of sand melted by means of fixed vegetable alkali, with little or no vegetable earth, gives a greater dispersive power; but both these give much less than flint glass, which consists of sand melted by means of minium and fixed alkali. It appears, therefore, that the dispersion of the rays is greatest when minium, or probably other metallic calces, are made use of; and that alkalies give a greater power of dispersion than vegetable or other earths. Mr Zieher of Petersburgh, however, informs us, that he has made a kind of glass, much superior in this respect to flint glass; but it does not as yet appear whether it be more fit for optical purposes than that commonly made use of. There seems no difficulty in augmenting the dispersive power, as that is found to depend on the quantity of minium or other flux: but thus we unfortunately increase also the capital fault to which flint glass and all compositions of that kind are subject; namely, the being subject to veins or small threads running through it. By these, even when so small as to be imperceptible to the naked eye, the rays which fall on them are diverted from their proper direction, and thereby render the images confused. This is owing to the greater density of the veins, as appears by their image being received on white paper, when the glass is held between the paper and the sun or a candle at a proper distance. The rays of light being then made to converge by the superior density of the veins, their images will appear as bright lines bordered with obscure edges on the paper. Flint glass is so much subject to this kind of imperfection, that it is with difficulty the opticians can pick out pieces of the size commonly used from a large quantity of the glass. It is farther to be regretted, that the minium which produces the greatest dispersive power, is likewise the very substance which renders flint glass much more subject to these imperfections than any other. The reason is, that the sand and earthy matters mix uniformly in fusion; and having not only a considerable degree of affinity towards each other, but also being not much different from each other, they are not apt to separate. On the other hand, when such a heavy substance as minium is added to these earthy substances, though it has a pretty strong tendency to unite with the earthy substances, it has none with the fixed alkali, which is another ingredient in this glass. Hence some parts of the glass will contain more metallic matter than the rest; particularly that near the bottom of the pot, which is so full of large veins as to be applied only to the making of wares of little value. The veins in this case are formed by the descent of the minium at the bottom, which in its passage forms threads or veins by dragging other parts of the glass along with them.

The correction of this fault appears therefore to be very difficult. M. Macquer informs us, that he had in vain tried to remove it by very long fusion and a fierce fire; which indeed others have found by experience not to correct, but to augment the evil. Mr Keir is of opinion that some new composition must be discovered, which, along with a sufficient refractive power should possess a greater uniformity of texture; but he is likewise of opinion, that scarce any alteration in this respect could be made without injuring the colour of the glass. For optical purposes, however, our author does not think that an alteration in the colour of the ingredients would be very detrimental. "I am convinced (says he), that glasses sensibly tinged with colour, might transmit as much or more light than the best flint glass. For the colourless appearance of flint glass is an optical deception. The minium gives it a considerable tinge of yellow, and the alkali inclines it to a bluish cast, besides the colour arising from a greater or less impurity of the materials; so that the glass would actually be very sensibly coloured, unless by the addition of manganese, which is known to give a purplish red. Thus the other tinges are counteracted, but not effaced or destroyed as has been frequently imagined. By the mixture of the three principal colours, red, yellow, and blue, more or less exactly counterpoised, a certain dark shade is introduced, in which, as not any one of the colours predominates, no coloured tinge appears, but the effect is merely a diminution of the transparency of the glass, which, however, is too small for ordinary observation." Mr Keir is even of opinion, that a certain tinge of yellow would in many cases be of service, because it would exclude some of the blue rays, which being most refrangible are most injurious to the distinctness of vision.

Very considerable difficulties, however, must arise in attempting improvements of this kind; as the experiments must all be tried on a very large scale. This is not only attended with a very heavy expence in itself on account of the quantity of materials employed, but from the heavy duty of excise, which is rigorously exacted whether the glass be manufactured into saleable articles or not. It is observed in the manufacture of every kind of glass, that the glass in the middle of the area or transverse section of a pot is much purer and freer from veins and other imperfections than the part which is near the sides, and that the glass at the bottom is the worst of all. Consequently it is chiefly in large pots, such as are used in manufactures, that there is is a probability of success. Very fine and beautiful glasses, called *paste* and *artificial gems*, may be made in smaller pots or crucibles; but this glass is suffered to cool and subside in the vessel, by which means the contiguous parts are more uniform in their texture than can be expected in a piece of glass taken out of the pot while hot in the common way, by making it adhere and twist round an iron rod or pipe. But although the method of allowing the glass to cool in the pots is very advantageous for the purposes of the jeweller, it is by no means applicable to those of the optician. Glass cooled in that gradual manner, suffers some degree of crystallization or peculiar arrangement of its parts; the consequence of which is, that the rays of light undergo certain refractions independent on the form of the glass, which greatly affect the distinctness of vision in telescopes.

Musical GLASSES. See HARMONICA.

Looking GLASSES. See *LOOKING Glass*, MIRROR, and FOLIATING.

Burning GLASS. See *BURNING GLASS*.

Weather GLASS. See BAROMETER.

Cupping GLASS. See SURGERY.

Hour GLASS. See *HOUR Glass*.

Watch GLASS. See WATCH.

GLASS *Wort*. See SALSOLA, BOTANY *Index*.

GLASTONBURY, a town of Somersetshire in England; situated in W. Long. 2. 41. N. Lat. 51. 9. —It is noted for a famous abbey, some magnificent ruins of which still remain. The curious structure called *the Abbot's kitchen* is still pretty entire. The monks pretend that it was the residence of Joseph of Arimathea, and of St Patrick. The king of the West Saxons erected a church here, which he and the succeeding kings enriched to such a degree, that the abbot lived like a prince, had the title of *lord*, and sat among the barons in parliament; and no person, not even a bishop or prince, durst set foot on the isle of Avalon, in which the abbey stands, without his leave. The revenue of the abbey was above 40,000l. per ann. besides seven parks well stored with deer. The last abbot (Richard Whiting), who had 100 monks, and 300 domestics, was hanged in his pontificals, with two of his monks, on the Tor, a high hill in the neighbourhood, for refusing to take the oath of supremacy to Henry VIII. and surrender his abbey when required. Edgar and many other Saxon kings were buried here; and, as some will have it, Arthur the British king. Every cottage here has part of a pillar, a door, or a window of this fabric; of which there still remain the ruins of the choir, the middle tower and the chapels. The walls that remain of the abbey are overgrown with ivy, and the aspect of the whole is both melancholy and venerable. Here are two parish churches. This town, while under the protection of its abbots, was a parliamentary borough, but it lost that and its privilege of a corporation; the latter of which was, however, restored by Queen Anne, who granted it a new charter for a mayor and burgesses. The only manufactory here is stockings. At a little distance from the old church, and facing the monks churchyard, are two remarkable pyramids, with inscriptions, that are in characters unintelligible, and an image in bishop's vestments. The story of the Glastonbury thorn, and of its budding upon Christmas day, is well known. This is not correctly true; but if the winter is mild, it always buds about the latter end of December, but later if the weather is severe. Population 2337 in 1811.

GLATZ, a strong town of Silesia, capital of a county of the same name, seated on the river Neisse; and well fortified with a castle. The town contains about 6700 inhabitants. The county was ceded to the king of Prussia by the queen of Hungary in 1742; and is about 45 miles in length, and 25 in breadth. It has mines of pit coal, silver, and iron; good quarries, plenty of cattle, and fine springs of mineral water. The town is situated in E. Long. 16. 26. N. Lat. 50. 16.

GLAUBER, JOHN RHODOLPHUS, a celebrated German chemist, who flourished about the year 1646. He wrote a great number of different treatises on chemistry, some of which have been translated into Latin and French. All his works have been collected into one volume, entitled *Glauberus concentratus*, which was translated into English, and printed at London, in folio, in 1689.

GLAUBER'*s Salts*, or *Sulphate of Soda*. See CHEMISTRY *Index*.

GLAUCOMA, in *Medicine* and *Surgery*, the name of a disease in the eye, wherein the crystalline humour is turned of a blueish or greenish colour, and its transparency hereby diminished.—The word comes from γλαυκος, *cæsius*, "sea-green, sky-coloured or grayish."

Those in whom this disorder is forming, discover it hence, that all objects appear to them as through a cloud or mist; when entirely formed, the visual rays are all intercepted, and nothing is seen at all.

It is reckoned incurable, when inveterate, and in aged persons: and even under other circumstances, is very difficult of cure, externals proving of little service.

The internals best suited to it, are those used in the gutta serena. Jul. Cæsar Claudinus, Consul. 74. gives a remedy for the glaucoma.

The glaucoma is usually distinguished from the cataract or suffusion, in this, that in the cataract the whiteness appears in the pupil, very near the corner; but it shows deeper in the glaucoma. See SURGERY *Index*.

GLAUCUS, a marine god, or deity of the sea. There are a great many fabulous accounts of this divinity: but the poetical history of him is, that before his deification, he was a fisherman of the town of Anthedon, who having one day taken a considerable number of fishes, which he laid upon the bank, on a sudden perceived, that these fishes, having touched a kind of herb that grew on the shore, received new strength, and leaped again into the sea: upon the sight of which extraordinary accident, he was tempted to taste of the herb himself, and presently leaped into the sea after them, where he was metamorphosed into a Triton, and became one of the sea gods.

GLAUX, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 17th order, *Calycanthemæ*. See BOTANY *Index*.

GLAZIER, an artificer who works in glass.—The principal part of a glazier's business consists in fitting panes of glass to the sashes and window frames of houses, pictures, &c. and in cleaning the same.

GLAZING, the crusting over earthen ware with a vitreous substance, the basis of which is lead. See GLASS *of Lead*.

The workers of common earthen ware, however, are

Glazing.

not at the trouble of thus previously making a pure glass of lead. Their usual composition for glazing their ware is formed of white sand 40 pounds, of red lead 20 pounds, of pearl ashes 20 pounds, and of common salt 12 pounds. Powder the sand by grinding it, and then add it to the other ingredients and grind them together: after which calcine them for some time with a moderate heat, and when the mixture is cold, pound it to powder; and when wanted for use temper it with water. The proportion of these ingredients may be occasionally varied. The ware after being turned on the wheel and dried in the open air, is covered over with the above composition by means of a brush; and when set in the furnace the violent heat soon reduces it to a perfect glass, covering the whole internal and external surface of the vessel.

We may observe, however, in general, that lead ought to be excluded from the composition of glazings, and other fluxes substituted in its stead. A transparent glazing may be prepared without lead, by calcining 40 pounds of white sand, 25 pounds of pearl ashes, and 15 pounds of common salt; and proceeding as before: and a more perfect transparent glazing may be made of sand 40 pounds, of wood ashes perfectly burnt 50 pounds, of pearl ashes 10 pounds, and of common salt 12 pounds. The following receipts are taken for the most part from Kunckel, who says, that they are the true glazings used at Delft and other Dutch manufactories.

Black is made of eight parts of red lead, iron filings three, copper ashes three, and zaffer two measures. This when melted will make a brown black; and if you want it blacker, add more zaffer to it.

Blue is thus prepared: Take lead ashes or red lead one pound, clear sand or powdered flints two pounds, common salt two pounds, white calcined tartar one pound, Venice or other glass half a pound, zaffer half a pound; mix them well together and melt them for several times, quenching them always in cold water. If you would have it fine and good, it will be proper to put the mixture into a glass furnace for a day or two.

Another blue glazing may be formed of one pound of tartar, a quarter of a pound of red lead, half an ounce of zaffer, and a quarter of a pound of powdered flints, which are to be fused and managed as in the last receipt. Or, take two pounds of calcined lead and tin, add five pounds of common salt, five pounds of powdered flints, and of zaffer, tartar, and Venetian glass, each one pound. Calcine and fuse the mixture as before. Or, again, take of red lead one part, of sand three parts, and of zaffer one part. For a violet blue glazing, take four ounces of tartar, two ounces of red lead, five ounces of powdered flints, and half a drachm of manganese.

Brown is made of red lead and flints of each 14 parts, and of manganese two parts fused; or of red lead 12 parts, and manganese one part fused. A brown glazing, to be laid on a white ground, may be made of manganese two parts, and of red lead and white glass of each one part, twice fused.

Flesh coloured is made of 12 parts of lead ashes, and one of white glass.

Gold coloured. Take of litharge three parts, of sand or calcined flint one part; pound and mix these very well together, then run them into a yellow glass with a strong fire. Pound this glass, and grind it into a subtile powder, which moisten with a well saturated solution of silver; make it into a paste, which put into a crucible, and cover it with a cover. Give at first a gentle degree of fire; then increase it, and continue it till you have a glass, which will be green. Pound this glass again, and grind it to a fine powder; moisten this powder with some beer, so that by means of a hair pencil you may apply it upon the vessels or any piece of earthen ware. The vessels that are painted or covered over with this glazing must be first well heated, then put under a muffle; and as soon as the glass runs, you must smoke them, by holding them over burning vegetables, and take out the vessels. Mr Heinsius of Petersburgh, who sent this receipt to the Royal Society, uses the words *afflare debes fumum*, which is rendered *smoke them*, in the Transactions. Phil. Trans. N° 465. § 6.

Kunckel gives several preparations for a gold coloured yellow glazing. This may be produced by fusing a mixture of three parts of red lead, two parts of antimony, and one part of saffron of Mars; by again melting the powdered mass, and repeating the operation four times, or by fusing four or five times a composition of red lead and antimony of each an ounce, and of scales of iron half an ounce: or by calcining and fusing together eight parts of red lead, six parts of flints, one part of yellow ochre, one part of antimony, and one part of white glass. A transparent gold-coloured glazing may be obtained by twice fusing red lead and white flints, of each 12 parts, and of filings of iron one part.

Green may be prepared of eight parts of litharge or red lead, eight parts of Venice glass, four parts of brass dust or filings of copper; or of ten parts of litharge, twelve of flint or pebble, and one of *æs ustum* or copper ashes.—A fine green glazing may be produced by fusing one part of the Bohemian granate, one part of filings of copper, one part of red lead, and one part of Venetian glass; or by fusing one part of white glass, the same quantity of red lead, and also of filings of copper; powdering the mass, and adding one part of Bohemian granate to two parts of this powder. A fine green may be obtained by mixing and grinding together any of the yellow glazings with equal quantities of the blue glazings; and all the shades and teints of green will be had by varying the proportion of the one to the other, and by the choice of the kind of yellow and blue.

Sea green is made of five pounds of lead ashes, one pound of tin ashes, three pounds of flint, three quarters of a pound of salt, half a pound of tartar, and half a pound of copper dust.

Iron colour is prepared of 15 parts of lead ashes or red lead, 15 of white sand or flints, and five of calcined copper. This mixture is to be calcined and fused.

Liver colour is prepared of 12 parts of litharge, eight of salt, six of pebble or flint, and one of manganese.

Purple brown consists of lead ashes 15 parts, clean sand or powdered flints 18 parts, manganese one part, and white glass 15 measures, to which some add one measure of zaffer.

Red is made of antimony three pounds, litharge or red lead three, and rust of iron one: grind them to a fine powder. Or, take two pounds of antimony, three of red lead, and one of calcined saffron of Mars, and proceed as before.

White. The white glazing for common ware is made of 40 pounds of clear sand, 75 pounds of litharge or lead ashes, 26 of pot ashes, and ten pounds of salt: these are three times melted into a cake, quenching it each time in clear cold water. Or it may be made of 50 pounds of clean sand, 70 of lead ashes, 30 of wood ashes, and 12 of salt.

For a fine white: Take two pounds of lead and one of tin; calcine them to ashes; of this take two parts, calcined flint, white sand, or broken white glass, one part, and salt one part; mix them well together and melt them into a cake for use. The trouble of calcining the tin and lead may be prevented by procuring them in a proper state.

A very fine white glazing may be obtained by calcining two parts of lead and one part of tin; and taking one part of this mass, and of flints and common salt of each one part, and fusing the mixture.

A white glazing may be also prepared by mixing 100 pounds of masticot, 60 pounds of red lead, 20 pounds of calcined tin or putty, and 10 pounds of common salt, and calcining and powdering the mixture several times.

Yellow is prepared of red lead three pounds; calcined antimony and tin, of each two pounds; or, according to some, of equal quantities of the three ingredients. These must be melted into a cake, then ground fine; and this operation repeated several times; or it may be made of 15 parts of lead ore, three parts of litharge of silver, and 15 parts of sand.—A fine yellow glazing may be procured by mixing five parts of red lead, two parts of powdered brick, one part of sand, one part of the white glazings, and two parts of antimony, calcining the mixture and then fusing it. Or, take four parts of white glass, one part of antimony, three parts of red lead, and one part of iron scales, and fuse the mixture; or fuse 16 parts of flints, one part of iron filings, and 24 parts of litharge. A light yellow glazing may be produced with ten parts of red lead, three parts of antimony, and three of glass, and two parts of calcined tin. See *Gold colour*, above.—A *citron yellow* is made of six parts of red lead, seven parts of fine red brick dust, and two parts of antimony. This mixture must be calcined day and night for the space of four days, in the ash hole of a glass-house furnace, and at last urged to fusion.

For the glazing of Delft ware, Porcelain, Stoneware, &c. see the articles *Delft Ware*, Porcelain, and Pottery.

The Romans had a method of glazing their earthen vessels, which in many respects appears to have been superior to ours. The common brown glazing easily scales off, cracks, and in a short time becomes disagreeable to the eye. Besides, it is very easily destroyed by acids; nor can vessels glazed in this manner be even employed to hold water, without part of it oozing through their pores. Lead is also very destructive to the human body; and if acids are unwarily put into vessels glazed with lead, the liquors will receive a very dangerous impregnation from the metal. The Roman glazing, which is yet to be seen upon urns dug up in several places, appears to have been made of some kind of varnish; and Pliny gives us a hint that it was made of bitumen. He tells us that it never lost its beauty, and that at length it became customary to glaze over statues in this manner. As this varnish sunk deep into the substance of the ware, it was not subject to those cracks and flaws which disfigure our vessels; and as it was not liable to be corroded by acids, it could not be subject to any of the accidents which may ensue from the use of vessels glazed with lead.

GLEAD, or Glade, a name used in the northern parts of the kingdom for the kite. See Falco, Ornithology *Index*.

GLEAM is popularly used for a ray or beam of light. Among falconers a hawk is said to gleam when she casts or throws up filth from the gorge.

GLEANING, the act of gathering or picking up the ears of corn left behind after the field has been reaped and the crop carried home. By the customs of some countries, particularly those of Melun and Estampes, all farmers and others are forbid, either by themselves or servants, to put any cattle into the fields, or prevent the gleaning in any manner whatever for the space of 24 hours after the carrying off the corn, under the penalty of confiscation.

GLEBE, among miners, signifies a piece of earth in which is contained some mineral ore.

Glebe, in *Law*, the land belonging to a parish church besides the tithes.

GLECHOMA, Ground Ivy, a genus of plants belonging to the didynamia class, and in the natural method ranking under the 42d order, *Verticillatæ*. See Botany *Index*.

GLEDITSIA, Triple Thorned Acacia, or *Honey Locust*, a genus of plants belonging to the polygamia class, and in the natural method ranking under the 33d order, *Lomentaceæ*. See Botany *Index*.

GLEET, in *Medicine*, the flux of a thin limpid humour from the urethra. See Medicine *Index*.

GLENDALAGH, otherwise called *the Seven Churches*, anciently a celebrated town of Ireland, situated five miles north-west of Rathdrum, in the county of Wicklow, and province of Leinster. The name signifies "the valley of the two lakes." In this valley, surrounded by high and almost inaccessible mountains, St Kevin or Cavan, called also *St Coemgene*, about the middle of the 6th century, founded a monastery, which in a short time from the sanctity of its founder was much resorted to, and at length became a bishoprick and a religious city. St Kevin died 3d June 618, aged 120; and on that day annually numbers of persons flock to the Seven Churches to celebrate the festival of that venerated saint. During the middle ages the city of Glendalagh, called by Hovedon, *Episcopatus Bistagniensis*, was held in great esteem, and received several valuable donations and privileges, its episcopal jurisdiction extending to the walls of Dublin.—About the middle of the 12th century, on some account or other, it was much neglected by the clergy; and became, instead of a holy city, a den of thieves, wherefore Cardinal Papiro, in 1214, united it to the see of Dublin, which union was confirmed by King John. The O'Tools, chiefs of of Firthual, however, by the assistance of the Pope, continued long after this period to elect bishops and abbots to Glendalagh, though they had neither revenues or authority, beyond the district of Tuathal, which was the western part of the county of Wicklow; in consequence of which the city was suffered to decay, and had become nearly a desert, in 1497, when Dennis White, the last titular bishop, surrendered his right in the cathedral church of St Patrick, Dublin. From the ruins of this ancient city still remaining, it appears to have been a place of consequence, and to have contained seven churches and religious houses; small indeed, but built in a neat elegant stile, in imitation of the Greek architecture: the cathedral, the walls of which are yet standing, was dedicated to St Peter and St Paul. South of the cathedral stands a small church roofed with stone, nearly entire; and in several parts of the valley are a number of stone crosses, some of which are curiously carved, but without any inscriptions. In the north-west corner of the cemetery belonging to the cathedral stands a round tower, 95 feet high, and 15 in diameter; and in the cemetery of a small church, on the south side of the river, near the great lake, called the *Rhefeart church*, are some tombs, with Irish inscriptions, belonging to the O'Tools. In a perpendicular projecting rock on the south side of the great lake, 30 yards above the surface of the water, is the celebrated bed of St Kevin, hewn out of the rock, exceedingly difficult of access and terrible of prospect. Amongst the ruins have been discovered a number of stones, curiously carved, and containing inscriptions in the Latin, Greek, and Irish languages. As this city was in a valley, surrounded on all sides, except the east, by high, barren, and inaccessible mountains, the artificial roads leading thereto are by no means the least curious part of the remains; the principal is that leading into the county of Kildare through Glendason. This road for near two miles is yet perfect, composed of stones placed on their edges, making a firm and durable pavement, about 10 feet broad. At a small distance from St Kevin's bed, on the same side of the mountain, are to be seen the ruins of a small stone building called *Saint Kevin's cell.*

GLENOIDES, the name of two cavities, or small depressions, in the inferior part of the first vertebra of the neck.

GLIMMER, or GLIST. See MICA, MINERALOGY *Index*.

GLINUS, in *Botany*, a genus of plants belonging to the decandria class; and in the natural method ranking under the 22d order, *Caryophyllæ*. See BOTANY *Index*.

GLIRES, the name of Linnæus's fourth order of mammalia. See MAMMALIA *Index*.

GLISSON, FRANCIS, a learned English physician in the 17th century, was educated at Cambridge, and was made regius professor of that university. In 1634 he was admitted a fellow of the College of Physicians in London. During the civil wars, he practised physic at Colchester, and afterwards settled in London. He greatly improved physic by his anatomical dissections and observations, and made several new discoveries of singular use towards establishing a rational practice. He wrote, 1. *De rachitide*, &c. 2. *De lymphæductis nuper repertis:* with the *Anatomica prolegomena, et Anatomia hepatis.* 3. *De naturæ substantia energitica; seu de via vitæ naturæ, ejusque tribus primis facultatibus*, &c. quarto. 4. *Tractatus de ventriculo et intestinis*, &c. The world is obliged to him for the *capsula communis*, or *vagina portæ*.

GLISTER, in *Surgery*. See CLYSTER.

GLOBBA, a genus of plants belonging to the monandria class. See BOTANY *Index*.

GLOBE, in *Geometry*, a round or spherical body, more usually called a *Sphere*. See SPHERE.

GLOBE is more particularly used for an artificial sphere of metal, plaster, paper, or other matter; on whose convex surface is drawn a map, or representation either of the earth or heavens, with the several circles conceived thereon. See GEOGRAPHY.

Globes are of two kinds, *terrestrial* and *celestial*; each of very considerable use, the one in astronomy, and the other in geography, for performing many of the operations thereof in an easy obvious manner, so as to be conceived without any knowledge of the mathematical grounds of those arts.

The fundamental parts, common to both globes, are an axis, representing that of the world; and a spherical shell, or cover, which makes the body of the globe, on the external surface of which the representation is drawn. See GEOGRAPHY *Index*.

Globes, we have observed, are made of different materials, viz. silver, brass, paper, plaster, &c. Those commonly used are of plaster and paper. For the construction of globes, see GEOGRAPHY *Index*.

For the uses, &c. of the globes, see GEOGRAPHY and ASTRONOMY.

GLOBE Animal. See ANIMALCULE.

GLOBE Fish. See OSTRACION, ICHTHYOLOGY *Index*.

GLOBULARIA, GLOBULAR BLUE DAISY; a genus of plants, belonging to the tetrandria class; and in the natural method ranking under the 48th order, *Aggregatæ*. See BOTANY *Index*.

GLOBULE, a diminutive of globe, frequently used by physicians in speaking of the red particles of the blood. See BLOOD.

GLOCESTER, the capital of Glocestershire, in England, 106 miles from London. It is an ancient city; and by Antoninus is called *Clevum*, or *Glevum*, which Camden thinks was formed from the British *Caer-Glowe*, signifying "a fair city." It was one of the 28 cities built by the Britons before the arrival of the Romans, who made it one of their colonies, and in the eighth century it was esteemed one of the noblest cities in the kingdom. It has suffered considerably by fire at different periods. It stands upon a hill; and from the middle of the city, where the four principal streets meet, there is a descent every way, which makes it not only clean and healthy, but adds to the beauty of the place. Forging of iron seems to have been its manufacture so early as the time of William the Conqueror. King Henry VIII. made it the see of a bishop with a dean and six prebends. Its castle, which was erected in the time of William the Conqueror, is very much decayed; part of it is leased out by the crown; and the rest serves for a prison, one of the best in England. In its cathedral, which is an ancient but magnificent fabric, and has a tower reckoned

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Glocester. one of the most curious pieces of architecture in England, are the tombs of Robert duke of Normandy, son to William the Conqueror, and of Edward II. and there is a whispering place like to that of St Paul's at London. In the chapter house lies Strongbow who conquered Ireland. There are 12 chapels in it, with the arms and monuments of many great persons. King John made it a borough to be governed by two bailiffs. Henry III. who was crowned here, made it a corporation. By its present charter from Charles I. it is governed by a steward, who is generally a nobleman; a mayor; a recorder; 12 aldermen, out of whom the mayor is chosen; a town clerk; two sheriffs, chosen yearly out of 26 common councilmen; a sword-bearer; and four serjeants at mace. Here are 12 incorporated trading companies, whose masters attend the mayor on all public occasions, &c. Besides the cathedral, there are five parish churches in this city; which is likewise well provided with hospitals, particularly an infirmary upon the plan of those at London, Winchester, Bath, &c. Here is a good stone bridge over the river Severn, with a quay, wharf, and customhouse; but most of its business is engrossed by Bristol. King Edward I. held a parliament here in 1272, wherein some good laws were made, now called the *Statutes of Glocester;* and he erected a gate on the south side of the abbey, still called by his name, though almost demolished in the civil wars. King Richard II. also held a parliament here: and King Richard III. in consideration of his having (before his accession to the crown) borne the title of *Duke of Glocester*, added the two adjacent hundreds of Dudston and King's Barton to it, gave it his sword and cap of maintenance, and made it a county of itself by the name of the *county of the city of Glocester*. But after the Restoration the hundreds were taken away by act of parliament, and the walls pulled down; because the city shut the gates against Charles I. when he besieged it in 1643; by which, though the siege was raised by the earl of Essex, it had suffered 20,000l. damage, having 241 houses destroyed, which reduced it so much that it has scarce recovered its former size and grandeur. Before that time it had 11 parish churches, but six of them were then demolished. Here are abundance of crosses, and statues of the English kings, some of whom kept their Christmas here; several market houses supported with pillars; and large remains of monasteries, which were once so numerous, that it gave occasion to the monkish proverb, *As sure as God is in Glocester*. Here is a barley market; and a hall for the assizes, called the *Booth Hall*. Its chief manufacture is pins. Under the bridge is a water engine to supply the town, and it is served with it also from Robin Hood's well, to which is a fine walk from the city. Camden says, that the famous Roman way, called *Ermin Street*, which begins at St David's in Pembrokeshire, and reaches to Southampton, passes through this city. Here is a charity school for above 80 children, of whom above 70 are also clothed; and a well endowed blue-coat school. Population 8280 in 1811. The city sends two members to parliament. W. Long. 2. 13. N. Lat. 51. 48.

Glocester, Glocestershire.

GLOCESTER is also the name of two counties and of several towns in America; such as the county of Glocester in New Jersey, bounded on the north by Burlington, on the south by Salem and Cumberland, on the east by the Atlantic ocean, and on the west by the river Delaware. It contains 13,172 inhabitants, besides 191 slaves. Glocester in Virginia is a well cultivated and fruitful county, about 55 miles long and 30 broad, with a population of 13,498 souls, among whom are included 7063 slaves.

GLOCESTERSHIRE, a county of England, is bounded on the west by Monmouthshire and Herefordshire, on the north by Worcestershire, on the east by Oxfordshire and Warwickshire, and on the south by Wiltshire, and part of Somersetshire. It is sixty miles in length, twenty-six in breadth, and one hundred and sixty in circumference; containing 1,100,000 acres, 320 parishes, 1229 villages, 2 cities, and 28 market towns. In 1811 it contained 54,040 houses, and 285,514 inhabitants. It sends only 8 members to parliament, 6 for three towns, viz. Glocester, Tewkesbury, and Cirencester; and two for the county. Its manufactures are woollen cloths of various kinds, men's hats, leather, pens, paper, bar iron, edge tools, nails, wire, tinned plates, brass, &c.: and of the principal articles of commerce of the county, it exports cheese 8000 tons; bacon, grain, cyder, 5000l. worth; perry, fish, 4000l. worth, &c. It lies in the diocese that takes its name from the capital, and in the Oxford circuit. The air of the county is very wholesome, but the face of it is very different in different parts: for the eastern part is hilly, and is called *Cotteswold;* the western woody, and called the *Forest of Dean;* and the rest is a fruitful valley, through which runs the river Severn. This river is in some places between two and three miles broad; and its course through the county, including its windings, is not less than seventy miles. The tide of flood, called the *Boar*, rises very high, and is very impetuous. It is remarkable, that the greatest tides are one year at the full moon, and the other at the new; one year the night tides, and the next the day. This river affords a noble conveyance for goods and merchandise of all sorts to and from the county; but it is watered by several others, as the Wye, the Avon, the Isis, the Leyden, the Frome, the Stroud, and Windrush, besides lesser streams, all abounding with fish, the Severn in particular with salmon, conger eels, and lampreys. The soil is in general very fertile, though pretty much diversified, yielding plenty of corn, pasture, fruit, and wood. In the hilly part of the county, or Cotteswold, the air is sharper than in the lowlands; and the soil, though not so fit for grain, produces excellent pasture for sheep; so that of the four hundred thousand that are computed to be kept in the county, the greater part are fed here. Of these sheep the wool is exceeding fine; and hence it is that this shire is so eminent for its manufacture of cloth, of which fifty thousand pieces are said to have been made yearly, before the practice of clandestinely exporting English wool became so common. In the vale, or lower part of the county, through which the Severn passes, the air and soil are very different from those of the Cotteswold: for the former is much warmer, and the latter richer, yielding the most luxuriant pastures; in consequence of which, numerous herds of black cattle are kept, and great quantities of that excellent cheese, for which it is so much celebrated, made in it. The remaining part of the county, called the Forest

Forest of Dean, was formerly almost entirely overrun with wood, and extended 20 miles in length, and 10 in breadth. It was then a nest of robbers, especially towards the Severn; but now it contains many towns and villages, consisting chiefly of miners, employed in the coal pits, or in digging for or forging iron ore, with both which the forest abounds. These miners have their particular laws, customs, courts, and judges: and the king, as in all royal forests, has a swain-mote for the preservation of the vert and venison. This forest was anciently, and is still noted for its oaks, which thrive here surprisingly; but as there is a prodigious consumption of wood in the forges, it is continually dwindling away. A navigable canal is made from Stroud to Framilode, forming a junction between the Severn and Thames. Its chalybeate springs are, St Anthony's well, in Abbenhall parish; at Barrow and Maredon, in Bodington parish; at Ash-church, near Tewkesbury; at Dumbleton, near Winchcomb; at Easington, near Dursley; and at Cheltenham. Its ancient fortifications, attributed to the Romans, Saxons, or Danes, are Abston and Wick, and at Dointon, Dixton, Addlesthorp, Knole, Over Upton, and Hanham. See GLOCESTERSHIRE, SUPPLEMENT.

GLOCHIDON, a genus of plants, belonging to the monœcia class. See BOTANY *Index*.

GLOGAW, a strong town of Germany, in Silesia, and capital of a duchy of the same name. It is not very large, but is well fortified on the side of Poland. It has a handsome castle, with a tower, in which several counsellors were condemned by Duke John, in 1498, to perish with hunger. Besides the Papists, there are a great number of Protestants and Jews. It was taken by assault, by the king of Prussia, in 1741, and the garrison made prisoners. After the peace in 1742, the king of Prussia settled the supreme court of justice here, it being, next to Breslaw, the most populous place in Silesia. It is seated on the river Oder, in E. Long. 16. 15. N. Lat. 51. 39.

GLOGAW *the* LESS, a town of Silesia, in the duchy of Oppeln, now in the possession of the king of Prussia. It is 19 miles south of Oppeln, and 45 northwest of Breslaw. E. Long. 16. 15. N. Lat. 51. 38.

GLORIA PATRI, among ecclesiastical writers. See DOXOLOGY.

GLORIOSA, SUPERB LILY, a genus of plants, belonging to the hexandria class, and in the natural method ranking under the 11th order, *Sarmentosæ*. See BOTANY *Index*.

GLORY, renown or celebrity. The love of renown, or desire of fame and reputation, appears to be one of the principal springs of action in human society. Glory, therefore, is not to be contemned, as some of the ancient philosophers affected to teach: but it imports us to regulate our pursuit after it by the dictates of reason; and if the public approbation will not follow us in that course, we must leave her behind.—We ought to have our judgments well instructed as to what actions are truly glorious; and to remember, that in every important enterprise, as Seneca observes, *Rectè facti fecisse merces est; officii fructus, ipsum officium est:* "The reward of a thing well done, is to have done it; the fruit of a good office, is the office itself." Those who by other methods scatter their names into many mouths, show they rather hunt after a great reputation than a good one, and their reward is oftener infamy than fame.

Men generally, and almost instinctively, affix glory only to such actions as have been produced by an innate desire for public good; and we measure it by that degree of influence which any thing done has upon the common happiness.

If the actions of the hero conduct soonest to glory and with the greatest splendour, and if the victorious general is so great after a signal engagement; it is because the service he has done is for the moment, and for all; and because we think without reflecting, that he has saved our habitations, our wealth, and our children, and every thing that attaches us to life. If the man of science, who in his study has discovered and calculated the motions of the heavenly bodies, who in his alembics has unveiled some of the secrets of nature, or who has exhibited to mankind a new art, rises to fame with less noise; it is because the utility which he procures is more widely diffused, and is often of less service to the present than to succeeding generations.

The consequences, therefore, of these two advantages are as opposite as the causes are different; and while the benefits procured by the warrior appear to have no more influence, and while his glory becomes obscure, that of a celebrated writer or inventor still increases, and is more and more enlarged. His works every day bring back his name to that age which uses them, and thus still add to his celebrity and fame.

This posthumous fame indeed has been decried by some writers. In particular, the author of the *Religion of Nature delineated* has treated it as highly irrational and absurd. "In reality (says he) the man is not known ever the more to posterity, because his name is transmitted to them: He doth not live, because his name does. When it is said Julius Cæsar subdued Gaul, conquered Pompey, &c. it is the same thing as to say, the conqueror of Pompey was Julius Cæsar; i. e. Cæsar and the conqueror of Pompey is the same thing; Cæsar is as much known by one designation as by the other. The amount then is only this, that the conqueror of Pompey conquered Pompey; or somebody conquered Pompey; or rather, since Pompey is as little known now as Cæsar, somebody conquered somebody. Such a poor business is this boasted immortality! and such is the thing called glory among us! To discerning men this fame is mere air, and what they despise if not shun."

But surely it were to consider too curiously (as Horatio says to Hamlet) to consider thus. For (as the elegant author of Fitzosborne's Letters observes) although fame with posterity should be, in the strict analysis of it, no other than what is here described, a mere uninteresting proposition, amounting to nothing more than that somebody acted meritoriously; yet it would not necessarily follow, that true philosophy would banish the desire of it from the human breast: for this passion may be (as most certainly it is) wisely implanted in our species, notwithstanding the corresponding object should in reality be very different from what it appears in imagination. Do not many of our most refined and even contemplative pleasures owe their existence to our mistakes? It is but extending some of our senses to to a higher degree of acuteness than we now possess them, to make the fairest views of nature, or the noblest productions of art, appear horrid and deformed. To see things as they truly and in themselves are, would not always, perhaps, be of advantage to us in the intellectual world, any more than in the natural. But, after all, who shall certainly assure us, that the pleasure of virtuous fame dies with its possessor, and reaches not to a farther scene of existence? There is nothing, it should seem, either absurd or unphilosophical in supposing it possible at least, that the praises of the good and the judicious, the sweetest music to an honest ear in this world, may be echoed back to the mansions of the next; that the poet's description of Fame may be literally true, and though she walks upon earth, she may yet lift her head into heaven.

To be convinced of the great advantage of cherishing this high regard to posterity, this noble desire of an after life in the breath of others, one need only look back upon the history of the ancient Greeks and Romans. For what other principle was it which produced that exalted strain of virtue in those days, that may well serve, in too many respects, as a model to these? Was it not the *consentiens laus bonorum*, the *incorrupta vox benè judicantium* (as Tully calls it), "the concurrent approbation of the good, the uncorrupted applause of the wise," that animated their most generous pursuits?

In short, can it be reasonable to extinguish a passion which nature has universally lighted up in the human breast, and which we constantly find to burn with most strength and brightness in the noblest and best formed bosoms? Accordingly revelation is so far from endeavouring to eradicate the seed which nature has thus deeply planted, that she rather seems, on the contrary, to cherish and forward its growth. To be *exalted with honour*, and to be *had in everlasting remembrance*, are in the number of those encouragements which the Jewish dispensation offered to the virtuous; and the person from whom the sacred Author of the Christian system received his birth, is herself represented as rejoicing that *all generations should call her blessed*.

GLOSS, a comment on the text of any author, to explain his sense more fully and at large, whether in the same language or any other. See the article COMMENTARY.—The word, according to some, comes from the Greek γλωσσα, "tongue;" the office of a gloss being to explain the text, as that of the tongue is to discover the mind.

GLOSS is likewise used for a literal translation, or an interpretation of an author in another language word for word.

GLOSS is also used in matters of commerce, &c. for the lustre of a silk, stuff, or the like.

GLOSSARY, a sort of dictionary, explaining the obscure and antiquated terms in some old author; such are Du Cange's Latin and Greek Glossaries, Spelman's Glossary, and Kennet's Glossary at the end of his Parochial Antiquities.

GLOSSOPETRA, or GLOTTOPETRA, in *Natural History*, a kind of extraneous fossil, something in form of a serpent's tongue; frequently found in the island of Malta and other places.

The vulgar notion is, that they are the tongues of serpents petrified; and hence their name, which is a compound of γλωσσα, "tongue" and πετρα, "stone." Hence also their traditionary virtue in curing the bites of serpents. The general opinion of naturalists is, that they are the teeth of fishes, left at hand by the waters of the deluge, and since petrified.

The several sizes of the teeth of the same species, and those of the several different species of sharks, afford a vast variety of these fossil substances. Their usual colours are black, bluish, whitish, yellowish, or brown; and in shape they usually approach to a triangular figure. Some of them are simple; others are tricuspidate, having a small point on each side of the large one: many of them are quite straight; but they are frequently found crooked, and bent in all directions; many of them are serrated on their edges, and others have them plain; some are undulated on their edges, and slightly serrated on these undulations. They differ also in size as much as in figure; the larger being four or five inches long, and the smaller less than a quarter of an inch.

They are most usually found with us in the strata of blue clay, though sometimes also in other substances, and are frequent in the clay pits of Richmond and other places. They are very frequent also in Germany, but nowhere so plentiful as in the island of Malta.

The Germans attribute many virtues to these fossil teeth; they call them cordials, sudorifics, and alexipharmics: and the people of Malta, where they are extremely plentiful, hang them about their children's necks to promote dentition. They may possibly be of as much service this way as an anodyne necklace; and if suspended in such a manner that the child can get them to its mouth, may, by their hardness and smoothness, be of the same use as a piece of coral.

GLOTTIS, in *Anatomy*, the narrow slit at the upper part of the aspera arteria, which is covered by the epiglottis when we hold our breath and when we swallow. The glottis, by its dilatation and contraction, modulates the voice. See ANATOMY, N° 183.

GLOVE, a covering for the hand and wrist.

Gloves, with respect to commerce, are distinguished into leathern gloves, silk gloves, thread gloves, cotton gloves, worsted gloves, &c. Leathern gloves are made of chamois, kid, lamb, doe, elk, buff, &c. Gloves now pay a duty to the king, which increases according to their value.

To throw the glove, was a practice or ceremony very usual among our forefathers; being the challenge whereby another was defied to single combat. It is still retained at the coronation of our kings; when the king's champion casts his glove in Westminster hall. See CHAMPION.

Favyn supposes the custom to have arisen from the eastern nations, who in all their sales and deliveries of lands, goods, &c. used to give the purchaser their glove by way of livery or investiture. To this effect he quotes Ruth iv. 7. where the Chaldee paraphrase calls *glove* what the common version renders by *shoe*. He adds, that the Rabbins interpret by *glove* that passage in the cviiith Psalm, *In Idumeam extendam calceamentum meum*, "Over *Edom* will I cast out my shoe." Accordingly, among us, he who took up the *glove*, declared thereby his acceptance of the challenge; and as a part of the ceremony, continues Favyn, took the *glove* off his own right hand, and cast it upon the ground, Glove, Glover.

ground, to be taken up by the challenger. This had the force of a mutual engagement on each side, to meet at the time and place which should be appointed by the king, parliament, or judges. The same author asserts, that the custom which still obtains of blessing *gloves* in the coronation of the kings of France, is a remain of the eastern practice of giving possession with the *glove*, lib. xvi. p. 1017, &c.

Anciently it was prohibited the judges to wear gloves on the bench. And at present in the stables of most princes, it is not safe going in without pulling off the gloves.

GLOVER, Richard, the author of Leonidas and several other esteemed works, was the son of Richard Glover, a Hamburgh merchant in London, and was born in St Martin's lane in the year 1712. He very early showed a strong propensity to and genius for poetry; and while at school, he wrote, amongst other pieces, a poem to the memory of Sir Isaac Newton, prefixed to the view of that incomparable author's philosophy, published in 4to, in 1728, by his intimate friend Dr Pemberton. But though possessed of talents which were calculated to excel in the literary world, he was content to devote his attention to commerce, and at a proper period commenced a Hamburgh merchant. He still, however, cultivated literature, and associated with those who were eminent in science. One of his earliest friends was Matthew Green, the ingenious but obscure author of some admirable poems, which in 1737, after his death, were collected and published by Mr Glover. In 1737, Mr Glover married Miss Nunn, with whom he received a handsome fortune; and in the same month published Leonidas, a poem in 4to, which in this and the next year passed through three editions. This poem was inscribed to Lord Cobham; and on its first appearance was received by the world with great approbation, though it has since been unaccountably neglected. Lord Lyttleton, in a popular publication called Common Sense, and in a poem addressed to the author, praised it in the warmest terms; and Dr Pemberton published, Observations on Poetry, especially epic, occasioned by the late poem upon Leonidas, 1738, 12mo, merely with a view to point out its beauties. In 1739, Mr Glover published "London, or the Progress of Commerce," 4to; and a ballad entitled, Hosier's Ghost. Both these pieces seem to have been written with a view to incite the public to resent the misbehaviour of the Spaniards; and the latter had a very considerable effect. The political dissensions at this period raged with great violence, and more especially in the metropolis; and at different meetings of the livery on those occasions, Mr Glover was always called to the chair, and acquitted himself in a very able manner, his conduct being patriotic and his speeches masterly. His talents for public speaking, his knowledge of political affairs, and his information concerning trade and commerce, soon afterwards pointed him out to the merchants of London as a proper person to conduct their application to parliament on the subject of the neglect of their trade. He accepted the office; and in summing up the evidence gave very striking proofs of his oratorical powers. This speech was pronounced Jan. 27. 1742.

In the year 1744 died the duchess of Marlborough, and by her will left to Mr Glover and Mr Mallet 500l. each, to write the History of the Duke of Marlborough's Life. This bequest, however, never took place. It is supposed, that Mr Glover very early renounced his share of it; and Mallet, though he continued to talk of performing the task almost as long as he lived, is now known never to have made the least progress in it. About this period Mr Glover withdrew a good deal from public notice, and lived in retirement. He had been unsuccessful in his business; and with a very laudable delicacy had preferred an obscure retreat to popular observation, until his affairs should put on a more prosperous appearance. He had been honoured with the attention of Frederick prince of Wales, who once presented him with a complete set of the classics, elegantly bound; and, on his absenting himself for some time on account of the embarrassment in his circumstances, sent him, it is said, 500l. The prince died in March 1751; and in May following Mr Glover was once more drawn from his retreat by the importunity of his friends, and stood candidate for the place of chamberlain of London. It unfortunately happened that he did not declare himself until most of the livery had engaged their votes; by which means he lost his election.

Glover.

In 1753, Mr Glover produced at Drury Lane his tragedy of Boadicea; which was acted nine nights, in the month of December. It had the advantage of the performance of Mr Garrick, Mr Mossop, Mrs Cibber, and Mrs Pritchard. From the prologue it seems to have been patronized by the author's friends in the city; and Dr Pemberton wrote a pamphlet to recommend it.—In 1761, Mr Glover published Medea, a tragedy written on the Greek model; but it was not acted until 1767, when it appeared for the first time on the stage at Drury Lane for Mrs Yates's benefit. At the accession of his present majesty, he appears to have surmounted the difficulties of his situation. In the parliament which was then called, he was chosen member for Weymouth, and continued to sit as such until the dissolution of it. He, about this time, interested himself about India affairs, at one of Mr Sullivan's elections; and in a speech introduced the fable of the man, horse, and bear; and drew this conclusion, that, whenever merchants made use of armed forces to maintain their trade, it would end in their destruction.

In 1770, the poem of Leonidas requiring a new edition, it was republished in two volumes 12mo, corrected throughout, and extended from nine books to twelve. It had also several new characters added, besides placing the old ones in new situations. The improvements made in it were very considerable; but we believe the public curiosity, at this period, was not sufficiently alive to recompense the pains bestowed on this once popular performance. The calamities arising from the wounds given to public credit, in June 1772, by the failure of the bank of Douglas, Heron, and Co. in Scotland, occasioned Mr Glover's taking a very active part in the settling those complicated concerns, and in stopping the distress then so universally felt. In February 1774, he called the annuitants of that banking-house together, at the King's Arms tavern, and laid proposals before them for the security of their demands, with which they were fully satisfied. He also undertook to manage the interests of the merchants and traders of London concerned in the trade to Germany

many and Holland, and of the dealers in foreign linens, in their application to parliament in May 1774. Both the speeches made on these occasions were published in a pamphlet in that year. In the succeeding year he engaged on behalf of the West India merchants in their application to parliament, and examined the witnesses and summoned up the evidence in the same masterly manner he had done on former occasions. For the assistance he afforded the merchants in this business, he was complimented by them with a service of plate, of the value of 300l. The speech which he delivered in the house was in the same year printed. This, we believe, was the last opportunity he had of displaying his oratorical talents in public. Having now arrived at a period of life which demanded a recess from business, Mr Glover retired to ease and independence, and spent the remainder of his days with dignity and with honour. It is probable that he still continued his attention to his muse, as we are informed that, besides an epic poem of considerable length, he has left some tragedies and comedies behind him in manuscript. After experiencing for some time the infirmities of age, he departed this life 25th November 1785; leaving behind him a most estimable character as a man, a citizen, and a writer.

GLOW-WORM. See LAMPYRIS, ENTOMOLOGY *Index*.

GLUCINA, in *Chemistry*, an earthy substance which was discovered by Vauquelin in 1798, in analyzing the emerald, of which it forms a component part. For an account of its properties and combinations, see CHEMISTRY, N° 1165.

GLUCKSTADT, a strong and considerable town of Germany, in the circle of Upper Saxony, and duchy of Holstein, with a strong castle, and subject to Denmark. It is seated on the river Elbe, near its mouth, and 28 miles from Hamburgh. E. Long. 9. 20. N. Lat. 53. 31.

GLUE, among artificers, a tenacious viscid matter, which serves as a cement to bind or connect things together.

Glues are of different kinds, according to the various uses they are designed for, as the common glue, glove glue, and parchment glue; whereof the two last are more properly called *size*.

Hamel du Monceau has written one of the best works on the subject of glue. According to this author, glue was at first principally prepared from the membranous, tendinous, and cartilaginous parts of animals, and after being dried, they were melted into tablets. It is certain, however, that every animal substance containing jelly, may be used in the manufacture of glue; and, according to Du Hamel himself, a strong, but black-coloured glue may be obtained from bones and hartshorn, after they are dissolved in Papin's digester. Of the truth of this fact Papin himself likewise assures us, for he prepared a jelly from bones, and even from ivory, by which he glued together some pieces of broken glass; and subsequent experiments made by other chemists have confirmed his assertion.

To the information contained on this subject in the works of Papin, Spielman has added many valuable remarks. He not only extracted glue from bones, but also from all the solid parts of animals, by boiling alone, as well as from the teeth of the sea horse, the wild boar, the wood-louse, and the viper.

The glue manufactured in Europe is of different kinds; but that which is made in England is esteemed the best. Its colour is of a brownish red. The Flanders glue is considered as of an inferior quality to that made in England, while the glue manufactured in France is not so good as either. The reason assigned for this difference of quality is, that bones and sinews are made use of by the Flemish and French in the manufacture of this article, while the English employ skins, which yield a much stronger glue. Dr Lewis informs us that the English steep and wash the cuttings of the hides in water, then boil them in fresh water till the liquor becomes of a proper consistence; after which they strain it through baskets, allow it to settle, then expose it to further evaporation, and pour it into flat moulds, where it unites. When thoroughly cooled, it is converted into solid cakes, which are cut into pieces, and dried on a kind of net.

Grenet for many years turned his attention to the manufacturing of glue. Having made a number of experiments on every substance formerly employed for this purpose, he found that bones afford the most abundant quantity of glue, and yield it with facility. Having deprived them of the fat they contain, he procured a jelly by simply boiling them, which, when dried, and thus changed into glue, he found superior to that which was prepared in France, and nearly equal to the best glue of commerce.

From the experiments of Parmentier, it appears that six pounds of button-makers raspings yielded a pound of excellent glue, not inferior to that which is manufactured in England. The glue which he obtained from the filings of ivory was equally as good, but more highly coloured. The filings of horn yielded none of this substance.

To obtain glue as colourless as possible, a very small quantity of water should be employed for extracting the jelly, by which means it may be concentrated without long evaporation, as exposure to heat has always a greater or less influence on the colour in proportion to the time. The whiteness and transparency of the Flanders glue are said to originate from an adherence to this plan.

In their consistence, colour, taste, smell, and solubility, glues are found to differ from each other. Some glues will dissolve by agitation in cold water, while others are only soluble at the point of ebullition. It is generally admitted that the best glue is transparent, of a brownish yellow colour, and having neither taste nor smell. It is perfectly soluble in water, forming a viscous fluid, which, when dry, preserves its tenacity and transparency in every part, and has more solidity, colour and viscidity, in proportion to the age and strength of the animal from which it is produced.

For the following account of the manufacture of glue, we are indebted to Mr John Clennel of Newcastle. "The improvement (he observes) of any manufacture depends upon its easy access to men of science, and a prudential theorist can never be better employed than in attempting to reduce to regularity or to system the manufactures that may fall under his attention. In conformity to the first principle, I made some notes whilst visiting a glue manufactory a few years ago in Southwark, and those, interwoven with the remarks on that subject of some chemists of the first respectability, I take the liberty of sending

sending you: at the same time I must beg of you, or your correspondents, that where it may be corrected in any manner, it may be done, and I shall feel myself obliged by the attention.

"Glue is an inspissated jelly, made of the parings of hides or horns of any kind, the pelts obtained from furriers, and the hoofs and ears of horses, oxen, calves, sheep, &c. quantities of all which are imported in addition to the home supply, by many of the great manufacturers of this article: these are first digested in lime water, to cleanse them as far as it can from the grease or dirt they may have contracted; they are then steeped in clean water, taking care to stir them well from time to time; afterwards they are laid in a heap, and the superabundant water pressed out; then they are boiled in a large brass caldron with clean water, skimming off the dirt as it rises, and further cleansed by putting in, after the whole is dissolved, a little melted alum or lime finely powdered, which, by their detersive properties, still further purge it: the skimming is continued for some time, when the mass is strained through baskets, and suffered to settle, that the remaining impurities, if any, may subside; it is then poured gently into the kettle again, and further evaporated by boiling a second time, and skimming, until it becomes of a clear but darkish brown colour: when it is thought to be strong enough (which is known either by the length of time a certain quantity of water and materials have boiled, or by its appearance during ebullition), it is poured into frames or moulds of about six feet long, one broad, and two deep, where it hardens gradually as the heat decreases: out of these troughs or receivers it is cut, when cold, by a spade, into square pieces or cakes, and each of these placed within a sort of wooden box, open in three divisions to the back; in this the glue, as yet soft, is taken to a table by women, where they divide it into three pieces (A) with an instrument not unlike a bow, having a brass wire for its string; with this they stand behind the box and cut by its openings, from front to back; the pieces thus cut are taken out into the open air, and dried on a kind of coarse net work, fastened in moveable sheds of about four feet square, which are fastened in rows in the gluemaker's field (every one of which contains four or five rows of net work); when perfectly dry and hard, it is fit for sale.

"That is thought the best glue which swells considerably without melting, by three or four days immersiou in cold water, and recovers its former dimensions and properties by drying. Glue that has got frost, or that looks thick and black, may be melted over again and refined, with a sufficient quantity added of fresh to overcome any injury it may have sustained; but it is generally put into the kettle after what is in it has been purged in the second boiling. To know good from bad glue, it is necessary for the purchaser to hold it between his eye and the light, and if it appears of a strong dark brown colour, and free from cloudy or black spots, the article is good."

A glue that is colourless and of superior quality, is obtained from the skins of eels, and known by the name of *size*. It is even procured from vellum, parchment, and some of the white species of leather; but for common purposes this is by far too expensive, and is only made use of in those cases of delicate workmanship where glue would be too gross. The skins of the rabbit, hare, and cat, are made use of in the manufacturing of size, by those who are employed in gilding gold, polishing, and painting, in various colours.

From the experiments of Mr Hatchett it appears, that membrane yields different quantities of gelatine, the solutions of which evaporated to dryness, afforded him an opportunity of observing the different degrees of viscidity and tenacity of mucilage, size, and glue. He also found that the more viscid glues are obtained with greater difficulty than such as are less so. When a cake of glue has been steeped three or four days in cold water, it is considered of the best quality, if it swell much without being dissolved, and if, when taken out, it recovers its original figure and hardness by drying.

On comparing the skins of different animals, Mr Hatchett found, that such as were most flexible more readily yielded their gelatine, and that produced from the skin of the rhinoceros was by far the most viscid of any. The true skin of any animal was most affected by long boiling; but the hide of the rhinoceros was the most insoluble.

He found that hair was not so much affected as skin; but the cartilages of the joints, when boiled long in water, were as perfectly soluble as the cutis, which is not the case with the other cartilages, as they afford little or no gelatine. The horns of the ox, ram, and goat, are very different from those of the stag; and the small quantity of gelatine they are found to contain, is produced more gradually, and with greater difficulty.

According to Hatchett, the effects of diluted nitric acid on the substances commonly employed in the manufacturing of glue, were exactly analogous to those of boiling water, and were always most powerful on those substances which contained the greatest quantity of gelatine. Almost all animal substances are convertible either into glue or soap, with this additional advantage, that those parts of them which would not be employed in making the one, are the most proper in the manufacture of the other.

Another fine species of glue, known by the name of *isinglass*, is the produce of certain fish, very common in the Russian seas, found on entering the rivers Wolga, Lyak, Don, and Danube. In Muscovy it is prepared of the *sturgeon* and the *storled*, which yield the most beautiful isinglass. The fish from fresh water are esteemed the best, as they afford an isinglass more flexible and transparent than any other.

When the bladder is extracted, it is washed in water to free it from the blood, if any adheres to it, but, not otherwise. It is then cut longitudinally, and the outer membrane taken off, the colour of which is brown, while the other membrane is so fine and white as to be with

(A) When the women, by mistake, cut only two, that which is double the size is called a *bishop*, and thrown into the kettle again.

with difficulty separated from the fish. They are formed into rolls of the size of the finger, with the fine membrane in the middle, and hung in the air to dry by degrees. Good isinglass is white, perfectly dry, semitransparent, and without smell. It is soluble in water with a gentle heat, but is easily dissolved in alcohol, in which it differs essentially from common glue. That which is made from different parts of sea wolves, sea cows, sharks, and whales, is employed in the clarifying of different wines and other liquors. Isinglass is of all shades of colour, from pure transparency to black; but such as are large and yellow are reckoned the worst. They are opaque, and their smell is disagreeable.

From 500 grains of isinglass Mr Hatchett obtained 56 grains of coal, from which $1\frac{1}{2}$ grain of earthy residuum were obtained by reducing it to ashes. Of consequence there were only 54.5 grains of pure coal, and the remaining 1.5 he found to be phosphate of soda, with an extremely small proportion of phosphate of lime.

GLUME (*gluma*), among botanists, a species of calyx, consisting of two or three membranous valves, which are often pellucid at the edges. This kind of calyx belongs to the grasses.

GLUT, among falconers, the slimy substance that lies in a hawk's paunch.

GLUTA, a genus of plants belonging to the gynandria class. See BOTANY *Index*.

GLUTÆUS, a name common to three muscles whose office it is to extend the thigh. See ANATOMY, *Table of the Muscles*.

GLUTTON. See MUSTELA, MAMMALIA *Index*.

GLUTTONY, a voracity of appetite, or a propensity to gormandizing.

There is a morbid sort of gluttony, called *fames canina*, "dog-like appetite," which sometimes occurs, and renders the person seized with it an object of pity and of cure as in other diseases: (see BULIMY).—But professed habitual gluttons may be reckoned amongst the monsters of nature, and deemed in a manner punishable for endeavouring to bring a dearth or famine into the places where they live. For which reason, people think King James I. was in the right, when a man being presented to him who could eat a whole sheep at one meal, he asked "What he could do more than another man?" and being answered "He could not do so much, said "Hang him then; for it is unfit a man should live that eats so much as 20 men, and cannot do so much as one."

The emperor Clodius Albinus would devour more apples at once than a bushel would hold. He would eat 500 figs to his breakfast, 100 peaches, 10 melons, 20 pound weight of grapes, 100 gnat-snappers, and 400 oysters. "Fye upon him (saith Lipsius); God keep such a curse from the earth."

One of our Danish kings named *Hardiknute* was so great a glutton, that a historian calls him *Bacca de Porco*, "Swine's mouth." His tables were covered four times a-day with the most costly viands that either the air, sea, or land, could furnish; and as he lived he died; for, revelling and carousing at a wedding banquet at Lambeth, he fell down dead. His death was so welcome to his subjects, that they celebrated the day with sports and pastimes, calling it *Hock tide*, which signifies scorn and contempt. With this king ended the reign of the Danes in England.

One Phagon, under the reign of the emperor Aurelianus, at one meal, ate a whole boar, 100 loaves of bread, a sheep, a pig, and drank above three gallons of wine.

We are told by Fuller *, that one Nicholas Wood, of Harrison in Kent, ate a whole sheep of 16s. price at one meal, raw; at another time 30 dozen of pigeons. At Sir William Sidley's in the same county, he ate as much victuals as would have sufficed 30 men. At Lord Wotton's mansion house in Kent, he devoured at one dinner 84 rabbits; which, by computation, at half a rabbit a man, would have served 168 men, He ate to his breakfast 18 yards of black pudding. He devoured a whole hog at one sitting down; and after it, being accommodated with fruit, he ate three pecks of damosins.

* *Worthies*, p. 86.

A counsellor at law, whose name was Mallet, well known in the reign of Charles I. ate at one time an ordinary provided in Westminster for 30 men at 12d. a-piece. His practice not being sufficient to supply him with better sort of meat, he fed generally on offals, ox livers, hearts, &c. He lived to almost 60 years of age, and for the seven last years of his life ate as moderately as other men. A narrative of his life was published.

GLYCINE, KNOBBED-ROOTED LIQUORICE-VETCH; a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

GLYCIRRHIZA, LIQUORICE; a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY and MATERIA MEDICA *Index*.

GLYNN, a county in the lower district of Georgia, in America, bounded on the east by the ocean, on the north by the river Alatamaha, by which it is separated from Liberty county, and on the south by Camden. The principal produce is cotton and rice. The chief town is Brunswick.

GLYPH, in *Sculpture* and *Architecture*, denotes any canal or cavity used as an ornament.

GMELIN, JOHN GEORGE, M. D. public lecturer on botany and physic at Tubingen, member of the Royal Society of Gottingen, and of the Academy of Sciences at Stockholm, was born on the 12th of August 1709, at Tubingen, where his father was an apothecary. Such was his diligence while at school, that he was qualified to attend the academical lectures at the age of 14, and was created doctor of medicine when only 19. He paid a visit about this time to the metropolis of the Russian empire, that he might have the pleasure of seeing some of his former teachers. There he became acquainted with Blumentrost, director of the academy, who introduced him to the meetings of the members, and procured for him an annual pension. At Petersburgh he was so much esteemed, that when he intimated a wish in 1729 to return to Tubingen, he was honoured with a place among the regular members of the academy, and chosen professor of chemistry and natural history in the year 1731. In order to carry into execution a plan which had been formed by Peter the Great, for exploring a passage to China and Japan along the coast of the Russian empire, Gmelin.

Gmelin was selected along with two others, as properly qualified for that undertaking, and likewise to ascertain the boundaries of Siberia. The department of natural history was assigned to our author. He had with him and his companions, six students, two draftsmen, two hunters, two miners, four land-surveyors, and 12 soldiers, with a serjeant and drummer. They began their journey on the 19th of August 1733; and in 1736, Steller and a painter joined their society, in order to assist Gmelin in his arduous labours.

By exploring Kamtschatka, they hoped to accomplish their mission in a satisfactory manner, for which purpose Steller proceeded to this place, and the rest of the society continued their travels through Siberia. In February 1743 Gmelin returned to Petersburgh in safety after a dangerous journey which lasted nine years and a half, but proved of the utmost importance to various branches of science. He resumed the offices which he had filled before; and having paid a visit in 1747 to his native country, he was chosen professor, while absent, in the room of Bachmeister deceased. He was seized with a violent fever in May 1755, which put a period to his valuable life, in the 45th year of his age. He was undoubtedly one of the most eminent botanists of the last century, and has rendered his name immortal by his *Flora Sibirica, seu historia plantarum Siberiæ*, in four parts, large quarto. He determined the boundaries between Europe and Asia, which every celebrated geographer has adopted since his day. Through all his works the traces of great modesty, a sacred regard to truth, and the most extensive knowledge of nature, are remarkably conspicuous.

Gmelin, *Dr Samuel*, was born in 1743 at Tubingen, where he also studied, and became doctor in medicine in 1763. He was afterwards admitted a member of the Imperial Academy of Sciences at St Petersburg. He commenced his travels in June 1768; and having traversed the provinces of Moscow, Voronetz, New Russia, Azof, Casan, and Astracan, he visited, in 1770 and 1771, the different harbours of the Caspian, and examined with peculiar attention those parts of the Persian provinces which border upon that sea, of which he has given a circumstantial account in the three volumes of his travels already published. Actuated by a zeal for extending his observations, he attempted to pass through the western provinces of Persia, which are in a perpetual state of warfare, and infested by numerous banditti. Upon this expedition, he quitted, in April 1772, Einzillee, a small trading place in Ghilan, upon the southern shore of the Caspian; and, on account of many difficulties and dangers, did not, until December 2. 1773, reach Sallian, a town situated upon the mouth of the river Koor. Thence he proceeded to Baku and Kuba, in the province of Shirvan, where he met with a friendly reception from Ali Feth Khan, the sovereign of that district. After he had been joined by 20 Uralian Cossacks, and when he was only four days journey from the Russian fortress Kislar, he and his companions were, on the 5th of February 1774, arrested by order of Usméi Khan, a petty Tartar prince, through whose territories he was obliged to pass. Usméi urged as a pretence for this arrest, that 30 years ago several families had escaped from his dominions, and had found an asylum in the Russian territories; adding, that Gmelin should not be released until these families were restored. The professor was removed from prison to prison; and at length, wearied out with continued persecutions, he expired, July 27th, at Achmet-Kent, a village of Mount Caucasus. His death was occasioned partly by vexation for the loss of several papers and collections, and partly by disorders contracted from the fatigues of his long journey. Some of his papers had been sent to Kislar during his imprisonment, and the others were not without great difficulty rescued from the hands of the barbarian who had detained him in captivity. The arrangement of these papers, which will form a fourth volume of his travels, was at first consigned to the care of Guildenstaedt, but upon his death has been transferred to the learned Pallas.

Gmelin ‖ Gnostics.

GMELINA, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, *Personatæ*. See Botany *Index*.

GNAPHALIUM, Cud-weed, Goldy-Locks, Eternal Flower, &c.; a genus of plants belonging to the syngenesia class; and in the natural method ranking under the 49th order, *Compositæ*. See Botany *Index*.

GNAT. See Culex, Entomology *Index*.

GNESNA, a large and strong town of Prussian Poland, in the palatinate of Calish, with an archbishop's see, whose prelate was primate of Poland, and viceroy during the vacancy of the throne. It was the first town built in the kingdom, and formerly more considerable than at present. E. Long. 17. 42. N. Lat. 52. 26.

GNETUM, a genus of plants belonging to the monœcia class. See Botany *Index*.

GNIDIA, a genus of plants belonging to the octandria class. See Botany *Index*.

GNOMES, Gnomi, certain imaginary beings, who, according to the cabbalists, inhabit the inner parts of the earth. They are supposed small in stature, and the guardians of quarries, mines, &c. See Fairy.

GNOMON, in *Dialling*, the style, pin, or cock of a dial, which by its shadow shows the hour of the day. The gnomon of every dial represents the axis of the earth: (See Dial and Dialling).—The word is Greek, γνωμων, which literally implies something that makes a thing known; by reason that the style or pin indicates or makes the hour known.

Gnomon, in *Astronomy*, a style erected perpendicular to the horizon, in order to find the altitude of the sun. See Astronomy.

By means of a gnomon, the sun's meridian altitude, and consequently the latitude of the place, may be found more exactly than with the smaller quadrants. See Quadrant.

By the same instrument the height of any object may be found: for as the distance of the observer's eye from the gnomon, is to the height of the style; so is the distance of the observer's eye from the object, to its height.

For the uses and application of gnomons, see Geography.

Gnomon of a Globe; the index of the hour circle.

GNOMONICS, the art of dialling. See Dialling.

GNOSTICS, ancient heretics, famous from the first rise of Christianity, principally in the east.

It

Gnostics.

It appears from several passages of the sacred writings, particularly 1 John ii. 18. 1 Tim. vi. 20. and Col. ii. 8. that many persons were infected with the Gnostic heresy in the first century; though the sect did not render itself conspicuous, either for number or reputation, before the time of Adrian, when some writers erroneously date its rise.

The name is formed of the Latin *gnosticus*, and that of the Greek γνωστικος, "knowing," of γινωσκω, "I know;" and was adopted by those of this sect, as if they were the only persons who had the true knowledge of Christianity. Accordingly, they looked on all other Christians as simple, ignorant, and barbarous persons, who explained and interpreted the sacred writings, in a too low, literal, and unedifying signification.

At first the Gnostics were only the philosophers and wits of those times, who formed for themselves a peculiar system of theology, agreeable to the philosophy of Pythagoras and Plato; to which they accommodated all their interpretations of Scripture. But

GNOSTICS afterwards became a general name, comprehending divers sects and parties of heretics, who rose in the first centuries, and who, though they differed among themselves as to circumstances, yet all agreed in some common principles. They were such as corrupted the doctrine of the gospel by a profane mixture of the tenets of the oriental philosophy, concerning the origin of evil and the creation of the world, with its divine truths. Such were the Valentinians, Simonians, Carpocratians, Nicolaitans, &c.

GNOSTICS was sometimes also more particularly attributed to the successors of the first Nicolaitans and Carpocratians, in the second century, upon their laying aside the names of the first authors. Such as would be thoroughly acquainted with all their doctrines, reveries, and visions, may consult St Irenæus, Tertullian, Clemens Alexandrinus, Origen, and St Epiphanius; particularly the first of these writers, who relates their sentiments at large: and confutes them at the same time: indeed, he dwells more expressly on the Valentinians than any other sort of Gnostics; but he shows the general principles whereon all their mistaken opinions were founded, and the method they followed in explaining scripture. He accuses them of introducing into religion certain vain and ridiculous genealogies, i. e. a kind of divine processions or emanations which had no other foundation but in their own wild imaginations.

In effect, the Gnostics confessed that these æons or emanations were nowhere expressly delivered in the sacred writings; but insisted at the same time, that Jesus Christ had intimated them in parables to such as could understand him. They built their theology not only on the gospels and the epistles of St Paul, but also on the law of Moses and the prophets. These last laws were peculiarly serviceable to them, on account of the allegories and allusions with which they abound, which are capable of different interpretations: Though their doctrine, concerning the creation of the world by one or more inferior beings of an evil or imperfect nature, led them to deny the divine authority of the books of the Old Testament, which contradicted this idle fiction, and filled them with an abhorrence of Moses and the religion he taught; alleging, that he was actuated by the malignant author of this world, who consulted his own glory and authority, and not the real advantage of men. Their persuasion that evil resided in matter, as its centre and source, made them treat the body with contempt, discourage marriage, and reject the doctrine of the resurrection of the body and its re-union with the immortal spirit. Their notion, that malevolent genii presided in nature, and occasioned diseases and calamities, wars, and desolations, induced them to apply themselves to the study of magic, in order to weaken the powers or suspend the influence of their malignant agents.

The Gnostics considered Jesus Christ as the Son of God, and consequently inferior to the Father, who came into the world for the rescue and happiness of miserable mortals, oppressed by matter and evil beings; but they rejected our Lord's humanity, on the principle that every thing corporeal is essentially and intrinsically evil; and therefore the greatest part of them denied the reality of his sufferings. They set a great value on the beginning of the gospel of St John, where they fancied they saw a great deal of their æons, or emanations, under the *Word*, the *Life*, the *Light*, &c. They divided all nature into three kinds of beings, viz. *hylic*, or material; *psychic*, or animal; and *pneumatic*, or spiritual. On the like principle they also distinguished three sorts of men; *material*, *animal*, and *spiritual*. The first, who were material and incapable of knowledge, inevitably perished, both soul and body; the third, such as the Gnostics themselves pretended to be, were all certainly saved; the psychic, or animal, who were the middle between the other two were capable either of being saved or damned, according to their good or evil actions.

With regard to their moral doctrines and conduct, they were much divided. The greatest part of the sect adopted very austere rules of life, recommended rigorous abstinence, and prescribed severe bodily mortifications, with a view of purifying and exalting the mind. However, some maintained, that there was no moral difference in human actions; and thus confounding right and wrong, they gave a loose rein to all the passions, and asserted the innocence of following blindly all their motions, and of living by their tumultuous dictates. They supported their opinions and practice by various authorities; some referred to fictitious and apocryphal writings of Adam, Abraham, Zoroaster, Christ, and his apostles; others boasted, that they had deduced their sentiments from secret doctrines of Christ, concealed from the vulgar; others affirmed, that they arrived at superior degrees of wisdom by an innate vigour of mind; and others asserted, that they were instructed in these mysterious parts of theological science by Theudas, a disciple of St Paul, and by Matthias, one of the friends of our Lord. The tenets of the ancient Gnostics were revived in Spain, in the fourth century, by a sect called the *Priscillianists*.

The appellation *Gnostic* sometimes also occurs in a good sense, in the ancient ecclesiastical writers, and particularly Clemens Alexandrinus, who, in the person of his Gnostic, describes the characters and qualities of a perfect Christian. This point he labours in the seventh book of his Stromata, where he shows that none but the Gnostic or learned person, has any true religion. He affirms, that were it possible for the knowledge

ledge of God to be separated from eternal salvation, the Gnostic would make no scruple to choose the knowledge; and that if God would promise him impunity in doing of any thing he has once spoken against, or offer him heaven on those terms, he would never alter a whit of his measures. In this sense the father uses Gnostics, in opposition to the heretics of the same name; affirming, that the true Gnostic is grown old in the study of the holy scriptures; and that he preserves the orthodox doctrine of the apostles and of the church; whereas the false Gnostic abandons all the apostolical traditions, as imagining himself wiser than the apostles. At length the name *Gnostic*, which originally was the most glorious, became infamous, by the idle opinions and dissolute lives of the persons who bore it.

GNU, or GNOU. See CAPRA, MAMMALIA *Index*.

GOA, a large and strong town of Asia, in the peninsula on this side the Ganges, and on the Malabar coast. It was taken by the Portuguese in 1508, and is the chief town of all their settlements on this side the Cape of Good Hope. It stands in an island of the same name, about 12 miles in length, and six in breadth; and the city is built on the north side of it, having the conveniency of a fine salt-water river, capable of receiving ships of the greatest burden, where they lie within a mile of the town. The banks of the river are beautified with a great number of handsome structures; such as churches, castles, and gentlemen's houses. The air within the town is unwholesome, for which reason it is not so well inhabited now as it was formerly. The viceroy's palace is a handsome building; and stands at a small distance from the river, over one of the gates of the city, which leads to a spacious street, terminated by a beautiful church. This city contains a great number of handsome churches, convents, and cloisters, with a stately large hospital; all well endowed, and kept in good repair. The market place occupies an acre of ground; and in the shops about it may be had the produce of Europe, China, Bengal, and other countries of less note. Every church has a set of bells, some of which are continually ringing. There are a great many Indian converts; but they generally retain some of their old customs, particularly they cannot be brought to eat beef. The clergy are very numerous and illiterate; but the churches are finely embellished, and have great numbers of images. In one of these churches, dedicated to Bon Jesus, is the chapel of St Francisco de Xaviere, whose tomb it contains: this chapel is a most superb and magnificent place; the tomb of the saint is entirely of fine black marble brought from Lisbon; on the four sides of it the principal actions of the life of the saint are most elegantly carved in basso relievo; these represent his converting the different nations to the Catholic faith: the figures are done to the life, and most admirably executed: it extends to the top in a pyramidical form, which terminates with a coronet of mother-of-pearl. On the sides of this chapel are excellent paintings, done by Italian masters; the subjects chiefly from Scripture. This tomb and the chapel appertaining to it, must have cost an immense sum of money; the Portuguese justly esteem it the greatest rarity in the place. The houses are large, and make a fine show; but within they are but poorly furnished. The inhabitants are contented with greens, fruits, and

roots; which, with a little bread, rice, and fish, is their principal diet, though they have hogs and fowls in plenty. The river's mouth is defended by several forts and batteries, well planted with large cannon on both sides; and there are several other forts in different places.

Goa is the residence of a captain general, who lived formerly in great splendour. He is also commander in chief of all the Portuguese forces in the East Indies. They kept here formerly two regiments of European infantry, three legions of sepoys, three troops of native light horse, and a militia; in all about 5000 men. But Goa is at present on the decline, and in little or no estimation with the country powers; indeed their bigotry and superstitious attachment to their faith is so general, that the inhabitants of the city and island are now reduced to about 20,000; the chief part of whom have been baptized; for they will not suffer any Mussulman or Gentoo to live within the precincts of the city: and these few are unable to carry on the husbandry or manufactures of the country. The court of Portugal is obliged to send out annually a very large sum of money, to defray the current expences of the government; which money is generally swallowed up by the convents and soldiery.

There was formerly an inquisition at this place, but it is now abolished; the building still remains, and by its black outside appears a fit emblem of the cruel and bloody transactions that passed within its walls! Provisions are to be had at this place in great plenty and perfection. E. Long. 73. 46. N. Lat. 15. 28.

GOAL. See GAOL.

GOAT. See CAPRA, MAMMALIA *Index*.

GOAT's Beard. See TRAGOPOGON, BOTANY *Index*.

GOAT-Sucker. See CAPRIMULGUS, ORNITHOLOGY *Index*.

GOBELIN, GILES, a celebrated French dyer, in the reign of Francis I. discovered a method of dyeing a beautiful scarlet, and his name has been given ever since to the finest French scarlets. His house, in the suburb of St Marcel at Paris, and the river he made use of, are still called *the Gobelins*. An academy for drawing, and a manufactory of fine tapestries, were erected in this quarter in 1666; for which reason the tapestries are called *the Gobelins*.

GOBIUS, a genus of fishes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

GOBLET, or GOBELET, a kind of drinking cup, or bowl, ordinarily of a round figure, and without either foot or handle. The word is French, *gobelet*; which Salmasius, and others, derive from the barbarous Latin *cupa*. Budeus deduces it from the Greek κυπελλον, *a sort of cup*.

GOD, one of the many names of the Supreme Being. See CHRISTIANITY, METAPHYSICS, MORAL PHILOSOPHY, and THEOLOGY.

GOD is also used in speaking of the false deities of the heathens, many of which were only creatures to which divine honours and worship were superstitiously paid.

The Greeks and Latins, it is observable, did not mean by the name of *God*, an all-perfect being, whereof eternity, infinity, omnipresence, &c. were essential attributes; with them, the word only implied an excellent and superior nature; and accordingly they gave the

the appellation *gods* to all beings of a rank or class higher and more perfect than that of men; and especially to those who were inferior agents in the divine administration, all subject to the one Supreme. Thus men themselves, according to their system, might become gods after death; inasmuch as their souls might attain to a degree of excellence superior to what they were capable of in life.

The first divines, Father Bossu observes, were the poets: the two functions, though now separated, were originally combined; or, rather, were one and the same thing.

Now the great variety of attributes in God, that is, the number of relations, capacities, and circumstances, wherein they had occasion to consider him, put these poets, &c. under a necessity of making a partition, and of separating the divine attributes into several persons; because the weakness of the human mind could not conceive so much power and action in the simplicity of one single divine nature. Thus the omnipotence of God came to be represented under the person and appellation of Jupiter; the wisdom of God, under that of Minerva; the justice of God, under that of Juno.

The first idols or false gods that are said to have been adored, were the stars, sun, moon, &c. on account of the light, heat, and other benefits, which we derive from them. Afterwards the earth came to be deified, for furnishing fruits necessary for the subsistence of men and animals; then fire and water became objects of divine worship, for their usefulness to human life. In process of time, and by degrees, gods became multiplied to infinity: and there was scarce any thing but the weakness or caprice of some devotee or other elevated into the rank of deity; things useless or even destructive not excepted. See MYTHOLOGY.

GODALMING, a town of England, in the county of Surrey, 35 miles from London. It is situated on the Wye, which has been rendered navigable for barges from Guildford, whence the communication is open to the Thames. The church is much admired for its neat and lofty spire. Here are manufactories of mixed and blue kerseys, of stockings, blankets, &c. Population 3543 in 1811. W. Long. 0. 31. N. Lat. 51. 1.

GODDARD, JONATHAN, an eminent physician and chemist, and one of the first promoters of the Royal Society, was born about the year 1617. He was elected a fellow of the college of physicians in 1646, and appointed reader of the anatomical lecture in that college in 1647. As he took part against Charles I. accepted the wardenship of Merton-college, Oxford, from Oliver Cromwell when chancellor, and sat sole representative of that university in Cromwell's parliament, he was removed from his wardenship in a manner disgraceful to him by Charles II. He was however then professor of physic at Gresham college, to which he retired, and continued to attend those meetings that gave birth to the Royal Society; upon the first establishment of which he was nominated one of the council. Being fully persuaded that the preparation of medicines was no less the physician's duty than the prescribing them, he constantly prepared his own; and in 1668 published a treatise recommending his example to general practice. He died of an apoplectic fit in 1674; and his memory was preserved by the drops that bore his name, otherwise called *Guttæ Anglicanæ*, the secret of which he sold to Charles II. for 5000l. and which Dr Lister assures us was only the volatile spirit of raw silk rectified with oil of cinnamon or some other essential oil. But he claims more particular regard, if what Bishop Seth Ward says be true, that he was the first Englishman who made that noble astronomical instrument, the telescope.

GODDESS, a heathen deity of the female sex.

The ancients had almost as many goddesses as gods: such were, Juno the goddess of air, Diana the goddess of woods, &c. and under this character were represented the virtues, graces, and principal advantages of life; truth, justice, piety, liberty, fortune, victory, &c.

It was the peculiar privilege of the goddesses to be represented naked on medals; for it was supposed that the imagination must be awed and restrained by the consideration of the divine character.

GODFATHERS and GODMOTHERS, persons who, at the baptism of infants, answer for their future conduct, and solemnly promise that they will renounce the devil and all his works, and follow a life of piety and virtue; and by this means lay themselves under an indispensable obligation to instruct them, and watch over their conduct.

This custom is of great antiquity in the Christian church; and was probably instituted to prevent children being brought up in idolatry, in case their parents died before they arrived at years of discretion.

The number of godfathers and godmothers is reduced to two, in the church of Rome; and three, in the church of England: but formerly they had as many as they pleased.

GODFREY of Bouillon, prince of Lorrain, a most celebrated crusader, and victorious general. He was chosen general of the expedition which the Christians undertook for the recovery of the Holy Land, and sold his dukedom to prepare for the war. He took Jerusalem from the Turks in 1099; but his piety, as historians relate, would not permit him to wear a diadem of gold in the city where his Saviour had been crowned with thorns. The sultan of Egypt afterwards sent a terrible army against him; which he defeated, with the slaughter of about 100,000 of the enemy. He died in 1160.

GODMANCHESTER, a town of Huntingdonshire 16 miles from Cambridge, and 57 from London. It has a bridge on the Ouse, opposite to Huntingdon; was formerly a Roman city, by the name of Durosiponte, where many Roman coins have been often dug up; and according to old writers, in the time of the Saxons it was the see of a bishop, and had a castle built by one Gorman a Danish king, from which the town was called *Gormanchester*. It is a large village, containing 1779 inhabitants in 1811, and is seated in a fertile soil, abounding with corn. It is said that no town in England kept more ploughs at work than this has done. The inhabitants boast they formerly received our kings as they made a progress this way, with nine score ploughs at a time, finely adorned with their trappings, &c. James I. made it a corporation by the name of two bailiffs, 12 assistants, and the commonalty of the borough of Godmanchester. Here is a school, called the Free Grammar-School of Queen Elizabeth. On the west side of the town is a noble though ancient seat of of the earl of Sandwich. Near this place, in the London road between Huntingdon and Caxton, is a tree well known to travellers by the name of Beggar's Bush.

GODSTOW, a place north-west of Oxford, in a sort of island formed by the divided streams of the Isis after being joined by the Evenlode. It is noted for catching of fish and dressing them; but more so for the ruins of that nunnery which fair Rosamond quitted for the embraces of Henry II. The people show a great hole in the earth here, where they say is a subterraneous passage, which goes under the river to Woodstock, by which she used to pass and repass. Little more remains at present than ragged walls, scattered over a considerable extent of ground. An arched gateway, and another venerable ruin, part of the tower of the conventual church, are still standing. Near the altar in this church fair Rosamond was buried, but the body was afterwards removed by order of a bishop of Lincoln, the visitor. The only entire part is small, formerly a private chapel. Not many years since a stone coffin, said to have been Rosamond's, who, perhaps, was removed from the church to this place, was to be seen here. The building has been put to various uses, and at present serves occasionally for a stable.

GODWIN, Francis, successively bishop of Llandaff and Hereford, was born in 1567. He was eminent for his learning and abilities; being a good mathematician, an excellent philosopher, a pure Latinist, and an accurate historian. He understood the true theory of the moon's motion a century before it was generally known. He first started those hints afterwards pursued by Bishop Wilkins, in his "Secret and swift messenger;" and published "A catalogne of the lives of English bishops." He has nevertheless been accused as a great simoniac, for omitting no opportunity of disposing of preferments in order to provide for his children. He died in 1648.

Godwin or *Goodwin Sands*. See Kent.

GODWIT. See Scolopax, Ornithology *Index*.

GOES, or Ter Goes, a strong and considerable town of the United Provinces, in Zealand, and capital of the island of South Beverland. It communicates with the sea by a canal; and is 10 miles east of Middleburgh, and 30 north of Ghent. Population 3700. E. Long. 3. 50. N. Lat. 51. 33.

GOG and Magog, two names generally joined together in scripture, (Ezek. xxxviii. 2, 3, &c. xxxix. 1, 2, &c. Rev. xx. 8.). Moses speaks of Magog the son of Japhet, but says nothing of Gog, (Gen. x. 2. 1 Chr. i. 5.). Gog was prince of Magog, according to Ezekiel. Magog signifies the country or people, and Gog the king of that country. The generality of the ancients made Magog the father of the Scythians and Tartars; and several interpreters discovered many footsteps of their name in the provinces of Great Tartary. Others have been of opinion that the Persians were the descendants of Magog; and some have imagined that the Goths were descended from Gog and Magog; and that the wars described by Ezekiel, and undertaken by Gog against the saints, are no other than those which the Goths carried on in the fifth age against the Roman empire.

Bochart has placed Gog in the neighbourhood of Caucasus. He derives the name of this celebrated mountain from the Hebrew *Gog chasan* "the fortress of Gog." He maintains that Prometheus, said to be chained to Caucasus by Jupiter, is Gog, and no other. There is a province in Iberia called the *Gogarene*.

Lastly, the generality believe, that Gog and Magog, mentioned in Ezekiel and the Revelation, are to be taken in an allegorical sense, for such princes as were enemies to the church and saints. Thus many by Gog in Ezekiel understand Antiochus Epiphanes, the persecutor of the Jews who were firm to their religion; and by the person of the same name in the Revelations, they suppose Antichrist to be meant, the great enemy of the church and faithful. Some have endeavoured to prove that Gog, spoken of in Ezekiel, and Cambyses king of Persia, were one and the same person; and that Gog and Magog in the Revelation denote all the enemies of the church, who should be persecutors of it to the consummation of ages.

GOGGLES, in *Surgery*, are instruments used for curing squinting, or that distortion of the eyes which occasions this disorder. They are short conical tubes, composed of ivory stained black, with a thin plate of the same ivory fixed in the tubes near their anterior extremities. Through the centre of each of these plates is a small circular hole, about the size of the pupil of the eye, for the transmission of the rays of light. These goggles must be continually worn in the daytime, till the muscles of the eye are brought to act regularly and uniformly, so as to direct the pupil straight forwards; and by these means the cure will be sooner or later effected.

GOGMAGOG hills, are hills so called, three miles from Cambridge, remarkable for the intrenchments and other works cast up here: whence some suppose it was a Roman camp; and others, that it was the work of the Danes.

GOGUET, Antony Yves, a French writer, and author of a celebrated work, intitled, *L'Origine des Loix, des Arts, des Sciences, et de leur Progrès chez les anciens Peuples*, 1758, 3 vols 4to. His father was an advocate, and he was born at Paris in 1716. He was very unpromising as to abilities, and reckoned even dull, in his early years; but his understanding developing itself, he applied to letters, and at length produced the above work. The reputation he gained by it was great; but he enjoyed it a very short time; dying the same year of the smallpox, which disorder, it seems, he always dreaded. It is remarkable, that Conrad Fugere, to whom he left his library and his MSS. was so deeply affected with the death of his friend, as to die himself three days after him. The above work has been translated into English, and published in 3 vols 8vo.

GOITO, a town of Italy, in the duchy of Mantua, taken by the Germans in 1701, and by the prince of Hesse in 1706. It is seated on the river Mincio, between the lake of Mantua and that of Garda, 10 miles north-west of Mantua. E. Long. 11. 0. N. Lat. 45. 16.

GOLCONDA, a province of Hindostan, now called Hyderabad. It is bounded on the north by that of Orixa, on the west by that of Balagate, on the south by Bisnagar, and on the east by the gulf of Bengal. It abounds in corn, rice, and cattle; but that which renders it most remarkable are the diamond-mines, which

which were formerly the most considerable in the world: they were usually purchased of the black merchants, who bought parcels of ground to search for these precious stones in. They have also mines of salt, fine iron for sword-blades, and curious callicoes and chintzes. As this is one of the few of the old Mogul governments remaining, more of the old forms and ceremonies of that great dynasty are retained at the nizam's court than at any other in Hindostan. There is a town of the same name, seated at the foot of a mountain. It was formerly the residence of the kings, and is now much frequented by the European merchants. E. Long. 78. 42. N. Lat. 17. 10.

GOLD, the most valuable of all the metals, is of a bright yellow colour when pure, but becomes more or less white in proportion as it is alloyed with other metals. It is the heaviest of all known bodies, platina only excepted. See CHEMISTRY and MINERALOGY *Index*.

Method of Recovering GOLD *from Gilt Works.* The solubility of gold, and the indissolubility of silver, in aqua regia, affords a principle on which gold may be separated from the surface of silver; and, on this foundation, different processes have been contrived, of which the two following appear to be the best.—Some powdered sal ammoniac, moistened with aquafortis into the consistence of a paste, is spread upon the gilt silver, and the piece heated till the matter smokes and becomes nearly dry: being then thrown into water, it is rubbed with a scratch brush composed of fine brass wire bound together; by which the gold easily comes off. The other way is, by putting the gilt silver into common aqua regia, kept so hot as nearly to boil, and turning the metal frequently till it becomes all over black; it is then to be washed with a little water, and rubbed with the scratch brush, to get off what gold the aqua regia may have left. This last method appears preferable to the other; as the same aqua regia may be made to serve repeatedly till it becomes saturated with the gold, after which the gold may be recovered pure by precipitation with sulphate of iron.

For separating gold from gilt copper, some direct a solution of borax to be applied on the gilt parts, but nowhere else, with a pencil, and a little powdered sulphur to be sprinkled on the places thus moistened; the principal use of the solution of borax seems to be to make the sulphur adhere; the piece being then made red hot, and quenched in water, the gold is said to be so far loosened as to be wiped off with a brush. Others mix the sulphur with nitre and tartar, and form the mixture with vinegar into a paste, which is spread upon the gilt parts.

Schlutter recommends mechanical means, as being generally the least expensive, for separating gold from the surface both of silver and copper. If the gilt vessel is round, the gold is conveniently got off by turning it in a lathe, and applying a proper tool, a skin being placed underneath for receiving the shavings: he says it is easy to collect into two ounces of shavings all the gold of a gilt vessel weighing thrice as many pounds. Where the figure of the piece does not admit of this method, it is to be properly fixed, and scrapers applied of different kinds according to its size and figure; some large, and furnished with two handles, one at each end; others small and narrow, for penetrating into depressed parts. If the gold cannot be got off by either of these ways, the file must be had recourse to, which takes off more of the metal underneath than the turning tool or the scraper, particularly than the former. The gold scrapings or filings may be purified from the silver or copper they contain, by the methods described under the article METALLURGY.

The editors of the *Encyclopédie* give a method of recovering the gold from wood that has been gilt on a water size: this account is extracted from a memoir of the same subject, presented to the Academy of Sciences by M. de Montamy. The gilt wood is steeped for a quarter of an hour in a quantity of water sufficient to cover it, made very hot: the size being thus softened, the wood is taken out, and scrubbed piece by piece, in a little warm water, with short stiff bristle brushes of different sizes, some small for penetrating into the carvings, and others large for the greater dispatch in flat pieces. The whole mixture of water, size, gold, &c. is to be boiled to dryness, the dry matter made red hot in a crucible to burn off the size, and the remainder ground with mercury, either in a mortar, or, where the quantity is large, in a mill.

GOLD-Coast. See GUINEA.

GOLD-Wire, a cylindrical ingot of silver, superficially gilt or covered with gold at the fire, and afterwards drawn successively through a great number of little round holes, of a wire-drawing iron, each less than the other, till it be sometimes no bigger than a hair of the head. See *WIRE-Drawing*.

It may be observed that, before the wire be reduced to this excessive fineness, it is drawn through above 140 different holes; and that each time they draw it, it is rubbed afresh over with new wax, both to facilitate its passage, and to prevent the silver's appearing through it.

GOLD-Wire flatted, is the former wire flatted between two rollers of polished steel, to fit it to be spun on a stick, or to be used flat, as it is, without spinning, in certain stuffs, laces, embroideries, &c. See STUFF, &c.

GOLD-Thread, or *Spun-gold*, is flatted gold, wrapped or laid over a thread of silk, by twisting it with wheel and iron bobbins.

To dispose the wire to be spun on silk, they pass it between two rollers of a little mill: these rollers are of nicely polished steel, and about three inches in diameter. They are set very close to each other, and turned by means of a handle fastened to one of them, which gives motion to the other. The gold wire in passing between the two is rendered quite flat, but without losing any thing of its gilding; and is rendered so exceedingly thin and flexible, that it is easily spun on silk-thread, by means of a hand-wheel, and so wound on a spool or bobbin. See *WIRE-Drawing*.

GOLD-Leaf or *Beaten Gold*, is gold beaten with a hammer into exceeding thin leaves, so that it is computed, that an ounce may be beaten into 1600 leaves, each three inches square, in which state it takes up more than 159,052 times its former surface.

The preparation of gold leaf, according to Dr Lewis, is as follows:

"The gold is melted in a black-lead crucible, with some

Gold. some borax, in a wind furnace, called by the workmen a *wind-hole:* as soon as it appears in perfect fusion, it is poured out into an iron ingot mould, six or eight inches long, and three quarters of an inch wide, previously greased, and heated, so as to make the tallow run and smoke, but not to take flame. The bar of gold is made red hot, to burn off the unctuous matter, and forged on an anvil into a long plate, which is further extended by being passed repeatedly between polished steel rollers, till it becomes a ribbon as thin as paper. Formerly the whole of this extension was procured by means of the hammer, and some of the French workmen are still said to follow the same practice: but the use of the flatting mill both abridges the operation, and renders the plate of more uniform thickness. The ribbon is divided by compasses, and cut with sheers into equal pieces, which consequently are of equal weights: these are forged on an anvil till they are an inch square; and afterwards well nealed, to correct the rigidity which the metal has contracted in the hammering and flatting. Two ounces of gold, or 960 grains, the quantity which the workmen usually melt at a time, make 150 of these squares, whence each of them weighs six grains and two-fifths; and as 902 grains of gold make a cubic inch, the thickness of the square plates is about the 766th part of an inch.

"In order to the further extension of these pieces into fine leaves, it is necessary to interpose some smooth body between them and the hammer, for softening its blow, and defending them from the rudeness of its immediate action: as also to place between every two of the pieces some proper intermedium, which, while it prevents their uniting together, or injuring one another, may suffer them freely to extend. Both these ends are answered by certain animal membranes.

"The goldbeaters use three kinds of membranes; for the outside cover, common parchment made of sheep skin; for interlaying with the gold, first the smoothest and closest vellum, made of calf skin; and afterwards the much finer skins of ox gut, stript off from the large straight gut slipt open, curiously prepared on purpose for this use, and hence called *goldbeater's skin.* The preparation of these last is a distinct business, practised by only two or three persons in the kingdom, some of the particulars of which I have not satisfactorily learned. The general process is said to consist, in applying one upon another, by the smooth sides, in a moist state, in which they readily cohere and unite inseparably; stretching them on a frame, and carefully scraping off the fat and rough matter, so as to leave only the fine exterior membrane of the gut; beating them between double leaves of paper, to force out what unctuosity may remain in them; moistening them once or twice with an infusion of warm spices; and lastly, drying and pressing them. It is said, that some calcined gypsum, or plaster of Paris, is rubbed with a hare's foot both on the vellum and the ox gut skins, which fills up such minute holes as may happen in them, and prevents the gold leaf from sticking, as it would do to the simple animal membrane. It is observable, that, notwithstanding the vast extent to which the gold is beaten between these skins, and the great tenuity of the skins themselves, yet they sustain continual repetitions of the process for several months, without extending or throwing thinner. Our workmen find, that, after 70 or 80 repetitions, the skins, though they contract no flaw, will no longer permit the gold to extend between them; but that they may be again rendered fit for use by impregnating them with the virtue which they have lost, and that even holes in them may be repaired by the dexterous application of fresh pieces of skin: a microscopical examination of some skins that had been long used plainly showed these repairs. The method of restoring their virtue is said in the *Encyclopédie* to be, by interlaying them with leaves of paper moistened with white wine vinegar, beating them for a whole day, and afterwards rubbing them over as at first with plaster of Paris. The gold is said to extend between them more easily, after they have been used a little, than when they are new.

"The beating of the gold is performed on a smooth block of black marble, weighing from 200 to 600 pounds, the heavier the better; about nine inches square on the upper surface, and sometimes less, fitted into the middle of a wooden frame, about two feet square, so as that the surface of the marble and the frame form one continuous plane. Three of the sides are furnished with a high ledge; and the front, which is open, has a leather flap fastened to it, which the gold-beater takes before him as an apron, for preserving the fragments of gold that fall off. Three hammers are employed, all of them with two round and somewhat convex faces, though commonly the workman uses only one of the faces: the first, called the *cutch hammer*, is about four inches in diameter, and weighs 15 or 16 pounds, and sometimes 20, though few workmen can manage those of this last size: the second, called the *shoddering hammer*, weighs about 12 pounds, and is about the same diameter: the third, called the *gold hammer*, or *finishing hammer*, weighs 10 or 11 pounds, and is nearly of the same width. The French use four hammers, differing both in size and shape from those of our workmen: they have only one face, being in figure truncated cones. The first has very little convexity, is near five inches in diameter, and weighs 14 or 15 pounds: the second is more convex than the first, about an inch narrower, and scarcely half its weight: the third, still more convex, is only about two inches wide, and four or five pounds in weight: the fourth or finishing hammer is near as heavy as the first, but narrower by an inch, and the most convex of all. As these hammers differ so remarkably from ours, I thought proper to insert them, leaving the workmen to judge what advantage one set may have above the other.

"A hundred and fifty of the pieces of gold are interlaid with leaves of vellum, three or four inches square, one vellum leaf being placed between every two of the pieces, and about 20 more of the vellum leaves on the outsides; over these is drawn a parchment case, open at both ends, and over this another in a contrary direction, so that the assemblage of gold and vellum leaves is kept tight and close on all sides. The whole is beaten with the heaviest hammer, and every now and then turned upside down, till the gold is stretched to the extent of the vellum; the case being from time to time opened for discovering how the extension goes on, and the packet, at times, bent and rolled

Gold.

rolled as it were between the hands, for procuring sufficient freedom to the gold, or, as the workmen say, to make the gold work. The pieces taken out from between the vellum leaves, are cut in four with a steel knife; and the 600 divisions, hence resulting, are interlaid, in the same manner, with pieces of the ox-gut skins five inches square. The beating being repeated with a lighter hammer till the golden plates have again acquired the extent of the skins, they are a second time divided in four: the instrument used for this division is a piece of cane cut to an edge, the leaves being now so light, that the moisture of the air or breath condensing on a metalline knife would occasion them to stick to it. These last divisions being so numerous, that the skins necessary for interposing between them would make the packet too thick to be beaten at once, they are parted into three parcels, which are beaten separately, with the smallest hammer, till they are stretched for the third time to the size of the skins: they are now found to be reduced to the greatest thinness they will admit of; and indeed many of them, before this period, break or fail. The French workmen, according to the minute detail of this process given in the *Encyclopédie*, repeat the division and the beating once more; but as the squares of gold, taken for the first operation, have four times the area of those used among us, the number of leaves from an equal area is the same in both methods, viz. 16 from a square inch. In the beating, however simple the process appears to be, a good deal of address is requisite, for applying the hammers so as to extend the metal uniformly from the middle to the sides: one improper blow is apt not only to break the gold leaves, but to cut the skins.

"After the last beating, the leaves are taken up by the end of a cane instrument, and, being blown flat on a leather cushion, are cut to a size, one by one, with a square frame of cane made of a proper sharpness, or with a frame of wood edged with cane: they are then fitted into books of 25 leaves each, the paper of which is well smoothed, and rubbed with red bole to prevent their sticking to it. The French, for sizing the leaves, use only the cane knife; cutting them first straight on one side, fitting them into the book by the straight side, and then paring off the superfluous parts of the gold about the edges of the book. The size of the French gold leaves is from somewhat less than three inches to three and three quarters square; that of ours, from three inches to three and three-eighths.

"The process of gold-beating is considerably influenced by the weather. In wet weather, the skins grow somewhat damp, and in this state make the extension of the gold more tedious: the French are said to dry and press them at every time of using; with care not to overdry them, which would render them unfit for farther service. Our workmen complain more of frost, which appears to affect the metalline leaves themselves: in frost, a gold leaf cannot easily be blown flat, but breaks, wrinkles, or runs together.

"Gold leaf ought to be prepared from the finest gold; as the admixture of other metals, though in too small a proportion to affect sensibly the colour of the leaf, would dispose it to lose of its beauty in the air. And indeed there is little temptation to the workman to use any other; the greater hardness of alloyed gold occasioning as much to be lost in point of time and labour, and in the greater number of leaves that break, as can be gained by any quantity of alloy that would not be at once discoverable by the eye. All metals render gold harder and more difficult of extension. Even silver, which in this respect seems to alter its quality less than any other metal, produces with gold a mixture sensibly harder than either of them separately, and this hardness is in no art more felt than in the goldbeater's. The French are said to prepare what is called the *green gold leaf*, from a composition of one part of copper and two of silver with eighty of gold. But this is probably a mistake: for such an admixture gives no greenness to gold: and I have been informed by our workmen, that this kind of leaf is made from the same fine gold as the highest gold-coloured sort, the greenish hue being only a superficial teint induced upon the gold in some part of the process: this greenish leaf is little otherwise used than for the gilding of certain books.

"But though the goldbeater cannot advantageously diminish the quantity of gold in the leaf by the admixture of any other substance with the gold, yet means have been contrived for some particular purposes, of saving the precious metal, by producing a kind of leaf, called *party-gold*, whose basis is silver, and which has only a superficial coat of gold upon one side: a thick leaf of silver and a thinner one of gold, laid flat on one another, heated and pressed together, unite and cohere; and being then beaten into fine leaves, as in the foregoing process, the gold, though its quantity is only about one-fourth of that of the silver, continues everywhere to cover it, the extension of the former keeping pace with that of the latter."

But it is to be observed by Mr Nicholson, that pure gold is too ductile to be worked between the goldbeater's skin. The newest skins will work the finest gold, and make the thinnest leaf, because they are the smoothest. Old skins, being rough or foul, require coarser gold. The finer the gold, the more ductile; insomuch, that pure gold, when driven out by the hammer, is too soft to force itself over the irregularities, but would pass round them, and by that means become divided into narrow slips. The finest gold for this purpose, has three grains of alloy in the ounce, and the coarsest twelve grains. In general the alloy is six grains, or one-eightieth part. That which is called pale gold contains three pennyweights of silver in the ounce. The alloy of gold leaf is silver, or copper, or both, and the colour is produced of various tints accordingly. Two ounces and two pennyweights of gold is delivered by the master to the workman, who, if extraordinarily skilful, returns two thousand leaves, or eighty books of gold, together with one ounce and six pennyweights of waste cuttings. Hence one book weighs 4.8 grains; and as the leaves measure 3.3 inches in the side, the thickness of the leaf is one two hundred and eighty-two thousandth part of an inch.

The yellow metal called Dutch gold is fine brass. It is said to be made from copper plates, by cementation with calamine, without subsequent fusion. Its thickness, compared with that of leaf gold, proved as 19 to 4, and under equal surfaces it is considerably more than twice as heavy as the gold. *Jour.* vol. i.

It

It must be observed, however, that gold is beaten more or less, according to the kind or quality of the work it is intended for; that for the gold-wire-drawers to gild their ingots withal, is left much thicker than that for gilding the frames of pictures, &c. See GILDING.

GOLD Brocade. See BROCADE.

Fulminating GOLD. See CHEMISTRY *Index.*

Mosaic GOLD, is gold applied in pannels on a proper ground, distributed into squares, lozenges, and other compartments; part of which is shadowed to raise or heighten the rest. See MOSAIC.

GOLD Plates for Enamelling are generally made of ducat gold, whose fineness is from $23\frac{1}{2}$ to $23\frac{3}{4}$ carats; and the finest gold is the best for this purpose, unless where some parts of the gold are left bare and unpolished, as in watch-cases, snuff-boxes, &c. for which purpose a mixture of alloy is necessary, and silver is preferred to copper, because the latter disposes the plates to tarnish and turn green. See ENAMELLING.

Shell-Gold is that used by the gilders and illuminers, and with which gold letters are written. It is made by grinding gold leaves, or gold-beaters fragments, with a little honey, and afterwards separating the honey from the powdered gold by means of water. When the honey is washed away, the gold may be put on paper or kept in shells; whence its name. When it is used, it is diluted with gum-water or soap-suds.—The German gold-powder, prepared from the Dutch gold leaf in the same manner, is generally used; and when it is well scoured with varnish, answers the end in japanners gilding as well as the genuine.

GOLD Size for burnished gilding is prepared of one pound and a half of tobacco-pipe clay, half an ounce of red chalk, a quarter of an ounce of black lead, forty drops of sweet oil, and three drams of pure tallow; grind the clay, chalk, and black lead, separately, very fine in water; then mix them together, add the oil and tallow, and grind the mixture to a due consistence.

Gold size of japanners may be made by pulverizing gum animi and asphaltum, of each one ounce; red lead, litharge of gold, and umber, of each one ounce and a half, mixing them with a pound of linseed oil, and boiling them, observing to stir them till the whole be incorporated, and appears on growing cold of the consistence of tar: strain the mixture through a flannel, and keep it stopped up in a bottle for use. When it is used, it must be ground with as much vermilion as will give it an opaque body, and diluted with oil of turpentine, so that it may be worked freely with the pencil. A simple preparation consists of one pound of linseed oil and four ounces of gum animi; powder the gum, and mix it gradually with the boiling oil; let it continue to boil till it becomes of the consistence of tar; strain it through a coarse cloth; keep and use it as the other.

GOLD-Finch. See FRINGILLA, ORNITHOLOGY *Index.*

GOLD Fish. See CYPRINUS, ICHTHYOLOGY *Index.*

GOLDEN, something that has a relation to gold or consists of gold.

GOLDEN-Calf, was a figure of a calf, which the Israelites cast in that metal, and set up in the wilderness to worship during Moses's absence in the mount; and which that legislator at his return burnt, grinded to powder, and mixed with the water the people were to drink off; as related in Exod. xxxii. The commentators have been divided on this article; the pulverizing of gold, and rendering it potable, is a very difficult operation in chemistry. Many, therefore, suppose it done by a miracle; and the rest, who allow of nothing supernatural in it, advance nothing but conjectures as to the manner of the process. Moses could not have done it by simple calcination, nor amalgamation, nor antimony, nor calcination; nor is there one of those operations that quadrates with the text.

M. Stahl has endeavoured to remove this difficulty. The method Moses made use of, according to this author, was by dissolving the metal with hepar sulphuris; only, instead of the vegetable alkali, he made use of the Egyptian natron, which is common enough throughout the east.

GOLDEN-Fleece, in the ancient mythology, was the skin or fleece of the ram upon which Phryxus and Hella are supposed to have swam over the sea to Colchis; and which being sacrificed to Jupiter, was hung upon a tree in the grove of Mars, guarded by two brazen-hoofed bulls, and a monstrous dragon that never slept; but was taken and carried off by Jason and the Argonauts.

Many authors have endeavoured to show that this fable is an allegorical representation of some real history, particularly of the philosophers stone. Others have explained it by the profit of the wool trade to Colchis, or the gold which they commonly gathered there with fleeces in the rivers. See ARGONAUTS.

Order of the GOLDEN Fleece, is a military order instituted by Philip the Good, duke of Burgundy, in 1429. It took its denomination from a representation of the golden fleece, borne by the knights on their collars, which consisted of flints and steels. The king of Spain is now grand-master of the order, in quality of duke of Burgundy: the number of knights is fixed to thirty-one.

It is usually said to have been instituted on occasion of an immense profit which that prince made by wool; though others will have a chemical mystery couched under it, as under that famous one of the ancients, which the adepts contend to be no other than the secret of the elixir, wrote on the fleece of a sheep.

Oliver de la Marche writes, that he had suggested to Philip I. archduke of Austria, that the order was instituted by his grandfather Philip the Good duke of Burgundy, with a view to that of Jason; and that John Germain bishop of Chalons, chancellor of the order, upon this occasion made him change his opinion, and assured the young prince that the order had been instituted with a view to the fleece of Gideon. William bishop of Tournay, chancellor likewise of the order, pretends that the duke of Burgundy had in view both the golden fleece of Jason and Jacob's fleece; i. e. the specked sheep belonging to this patriarch, according to agreement made with his father-in-law Laban. Which sentiment gave birth to a great work of this prelate in two parts: in the first, under the symbol of the fleece of Jason, is represented the virtue of magnanimity, which a knight ought to possess; and under the symbol of the fleece of Jacob he represents the virtue of justice.

Paradin is of the same mind; and tells us, that the duke designed to insinuate that the fabulous conquest which Jason is said to have made of the golden fleece in Colchis, was nothing else but the conquest of virtue, which gains a victory over those horrible monsters vice and our evil inclinations.

Golden Number, in *Chronology*, a number showing what year of the moon's cycle any given year is. See CHRONOLOGY, N° 27—30.

Golden Rod, in *Botany*. See SOLIDAGO, BOTANY *Index*.

Golden Rose. The pope annually consecrates a golden rose on the fourth Sunday in Lent, which is sent to princesses, or to some church, as a mark of his peculiar affection.

Golden Rule, in *Arithmetic*, a rule or praxis, of great use and extent in the art of numbers; whereby we find a fourth proportional to three quantities given.

The golden rule is also called the *Rule of Three*, and *Rule of Proportion*. See its nature and use under the article ARITHMETIC, N° 13.

GOLDENGEN, a town of Poland in the duchy of Courland, with a handsome castle, seated on the river Weia, in E. Long. 21. 44. N. Lat. 56. 48.

GOLDONI, CHARLES, a comic writer of considerable eminence, was born at Venice in the year 1707, in which city his father acted in the capacity of physician. His attachment to the drama became conspicuous even in childhood, which his father was fond of countenancing, erecting a theatre in his own house, where young Goldoni and some of his companions were the actors. It is said that he even drew the outlines of a comedy of his own invention when he was no more than eight years of age—a most extraordinary indication of his future eminence. He studied rhetoric at Perugia, in the college of the Jesuits, and prosecuted his philosophical studies at Rimini. The stage, however, had too many charms to allow him to pay much attention to Aristotle or Quintilian, and he eloped from Rimini with a company of comedians when they removed to Chiozza. In vain did his father attempt to make him fall in love with physic, or the study of the law; yet his ardent imagination was so forcibly struck with a particular church-ceremony, that he formed the resolution of commencing capuchin, but the dissipation of Venice soon destroyed this resolution. After the demise of his father, he was prevailed upon by his surviving parent to take up the profession of the law for immediate support, but some unknown reasons induced him to quit the bar after which he went to Milan, where he was appointed secretary to the Venetian resident.

At Milan he brought out his first performance, under the title of *Il Gondoliere Veneziano*. He removed afterwards to Verona, where he joined himself to a company of players; and here too he entered into a state of wedlock. He composed a number of pieces for the players to whom he attached himself. While at Venice, he formed the laudable resolution of reforming the Italian stage, which at that time was disgraced by contemptible farce and low buffoonery. He made himself acquainted with the true nature of comedy, and kept within the limits of nature and decorum. Such was the fertility of his genius, and such his indefatigable industry, that he produced no fewer than sixteen comedies and 42 other theatrical pieces in the course of twelve months! And what is most astonishing, some of these hasty performances are deemed his masterpieces.

His works in 10 vols. 8vo. were first printed in 1753, and in 1761 his new pieces amounted to 59. About this time he was invited to Paris by the manager of the Italian theatre in that city, to compose pieces for the stage, of which invitation he accepted. His first attempt was unsuccessful, because he had to contend with the pantomime drollery, which was most agreeable to the depraved taste of the times. When about to leave Paris on the expiration of his engagement, he was introduced to the court, and appointed teacher of the Italian languages to the princesses. He had lodgings in Versailles, but his pension was not sufficient to keep him from writing for the stage. When 62 years old, he ventured to compose in a foreign language, his *La Bourru Bienfaisant*, which was received in the court theatre with extraordinary applause. He was deprived of his pension in consequence of the revolution, and reduced to indigence. It ought to be confessed, however, that this versatile nation was just about to make him amends when he expired in 1792, and in the 85th year of his age. If the rapidity with which Goldoni composed was such as to prevent him from ranking with authors of the first class, it cannot be denied that his talent for comedy was very great. Some have given him the appellation of the *Moliere of Italy*, but this perhaps is too flattering a title. His whole works were printed at Leghorn about the years 1788 and 1791, in 31 volumes 8vo.

GOLDSMITH, or, as some choose to express it, *silversmith*, an artist who makes vessels, utensils, and ornaments, in gold and silver.

The goldsmith's work is either performed in the mould, or beat out with the hammer or other engine. All works that have raised figures are cast in a mould, and afterwards polished and finished; plates or dishes, of silver or gold, are beat out from thin flat plates; and tankards, and other vessels of that kind, are formed of plates soldered together, and their mouldings are beat, not cast. The business of the goldsmiths formerly required much more labour than it does at present; for they were obliged to hammer the metal from the ingot to the thinness they wanted; but there are now invented flatting-mills, which reduce metals to the thinness that is required, at a very small expence. The goldsmith is to make his own moulds; and for that reason, ought to be a good designer, and have a taste in sculpture: he ought also to know enough of metallurgy to be able to assay mixed metals, and to mix the alloy.

The goldsmiths in London employ several hands under them for the various articles of their trade; such are the jeweller, the snuff-box and toy-maker, the silver-turner, the gilder, the burnisher, the chaser, the refiner, and the gold-beater.

Goldsmiths are superior tradesmen; their wares must be assayed by the wardens of the company of this name in London, and marked; and gold is to be of a certain touch. No goldsmith may take above one shilling the ounce of gold, besides what he has for the fashioning, more than the buyer may be allowed for it at the king's exchange; and here any false metal shall be seized and forfeited to the king. The cities of

Goldsmith.

of York, Exeter, Bristol, &c. are places appointed for the assaying wrought plate of goldsmiths; also a duty is granted on silver-plate of sixpence an ounce, &c. Plate made by goldsmiths shall be of a particular fineness, on pain of forfeiting 10l. and if any parcel of plate sent to the assayers is discovered to be of a coarser alloy than the respective standards, it may be broken and defaced; and the fees for assaying are particularly limited.

GOLDSMITH, *Oliver*, a celebrated English writer, was born at Roscommon in Ireland in the year 1731. His father, who possessed a small estate in the county, had nine sons, of whom Oliver was the third. He was originally intended for the church; and with that view, after being well instructed in the classics, was, with his brother, the Rev. Henry Goldsmith, placed in Trinity College, Dublin, about the latter end of the year 1749. In this seminary of learning he continued a few years, when he took a bachelor's degree: but his brother not being able to obtain any preferment after he left the college, Oliver, by the advice of Dean Goldsmith of Cork, turned his thoughts to the study of physic; and, after attending some courses of anatomy in Dublin, proceeded to Edinburgh in the year 1751, where he studied the several branches of medicine under the different professors in that university. His beneficent disposition soon involved him in unexpected difficulties; and he was obliged precipitately to leave Scotland, in consequence of engaging himself to pay a considerable sum of money for a fellow-student.

A few days after, about the beginning of the year 1754, he arrived at Sunderland, near Newcastle, where he was arrested at the suit of a taylor in Edinburgh, to whom he had given security for his friend.

By the good offices of Laughlan Maclane, Esq. and Dr Sleigh, who were then in the college, he was soon delivered out of the hands of the bailiff; and took his passage on board a Dutch ship to Rotterdam, where, after a short stay, he proceeded to Brussels; he then visited great part of Flanders; and after passing some time at Strasburg and Louvain, where he obtained a degree of bachelor of physic, he accompanied an English gentleman to Berne and Geneva.

It is undoubtedly fact, that this ingenious unfortunate man travelled on foot most part of his tour. He had left England with very little money; and being of a philosophical turn, and at that time possessing a body capable of sustaining every fatigue, and a heart not easily terrified at danger, he became an enthusiast to the design he had formed of seeing the manners of different countries. He had some knowledge of the French language and of music, and he played tolerably well on the German flute; which, from an amusement, became at some times the means of subsistence. His learning produced him a hospitable reception at most of the religious houses; and his music made him welcome to the peasants of Flanders and other parts of Germany. "Whenever I approached," he used to say, "a peasant's house towards night-fall, I played one of my most merry tunes; and that procured me not only a lodging, but subsistence for the next day: but in truth (his constant expression), I must own, whenever I attempted to entertain persons of a higher rank, they always thought my performance odious, and never made me any return for my endeavours to please them."

Goldsmith.

On Mr Goldsmith's arrival at Geneva, he was recommended as a proper person for a travelling tutor to a young man, who had been unexpectedly left a considerable sum of money by his uncle Mr S——, formerly an eminent pawnbroker near Holborn. This youth, who had been articled to an attorney, on receipt of his fortune determined to see the world; and, on his engaging with his preceptor, made a proviso that he should be permitted to govern himself; and Goldsmith soon found his pupil understood the art of directing in money-concerns extremely well, as avarice was his prevailing passion. His questions were usually how money might be saved, and which was the least expensive course of travelling; whether any thing could be bought that would turn to account when disposed of again in London? Such curiosities on the way as could be seen for nothing he was ready enough to look at; but if the sight of them was to be paid for, he usually asserted that he had been told they were not worth seeing. He never paid a bill that he would not observe how amazingly expensive travelling was; and all this, though he was not yet twenty-one. During Goldsmith's continuance in Switzerland, he assiduously cultivated his poetical talent, of which he had given some striking proofs while at the college of Edinburgh. It was here he sent the first sketch of his delightful poem called the *Traveller*, to his brother the clergyman in Ireland, who, giving up fame and fortune, had retired with an amiable wife, to happiness and obscurity, on an income of only 40l. a-year.

From Geneva Mr Goldsmith and his pupil visited the south of France; where the young man, upon some disagreement with his preceptor, paid him the small part of his salary which was due, and embarked at Marseilles for England. Our wanderer was left once more upon the world at large, and passed through a variety of difficulties in traversing the greatest part of France. At length his curiosity being satiated, he bent his course towards England, and arrived at Dover the beginning of the winter 1758. When he came to London, his stock of cash did not amount to two livres. An entire stranger in this metropolis, his mind was filled with the most gloomy reflections on his embarrassed situation. With some difficulty he discovered that part of the town in which his old acquaintance Dr Sleigh resided. This gentleman received him with the warmest affection, and liberally invited him to share his purse till some establishment could be procured for him. Goldsmith, unwilling to be a burden to his friend, a short time after eagerly embraced an offer which was made him to assist the late Rev. Dr Milner in instructing the young gentlemen at the academy at Peckham; and acquitted himself greatly to the Doctor's satisfaction for a short time: but having obtained some reputation by the criticisms he had written in the Monthly Review, Mr Griffith, the proprietor, engaged him in the compilation of it; and, resolving to pursue the profession of writing, he returned to London, as the mart where abilities of every kind were sure of meeting distinction and reward. As his finances were by no means in a good state, he determined to adopt a plan of the strictest economy: and took

Goldsmith. took lodgings in an obscure court in the Old Bailey, where he wrote several ingenious little pieces. The late Mr Newberry, who at that time gave great encouragement to men of literary abilities, became a kind of patron to our young author; and introduced him as one of the writers in the Public Ledger, in which his Citizen of the World originally appeared, under the title of *Chinese Letters*.

Fortune now seemed to take some notice of a man she had long neglected. The simplicity of his character, the integrity of his heart, and the merit of his productions, made his company very acceptable to a number of respectable families; and he emerged from his shabby apartments in the Old Bailey to the politer air of the Temple, where he took handsome chambers, and lived in a genteel style. The publication of his Traveller, and his Vicar of Wakefield, was followed by the performance of his comedy of the Good-natured Man at Covent Garden theatre, and placed him in the first rank of the poets of the age.

Among many other persons of distinction who were desirous to know him was the duke of Northumberland; and the circumstance that attended his introduction to that nobleman is worthy of being related, in order to show a striking trait of his character. "I was invited," said the Doctor, (as he was then universally called), "by my friend Mr Percy, to wait upon the duke, in consequence of the satisfaction he had received from the perusal of one of my productions. I dressed myself in the best manner I could; and, after studying some compliments I thought necessary on such an occasion, proceeded to Northumberland-house, and acquainted the servants that I had particular business with his Grace. They showed me into an antichamber; where, after waiting some time, a gentleman very genteelly dressed made his appearance. Taking him for the duke, I delivered all the fine things I had composed in order to compliment him on the honour he had done me; when, to my great astonishment, he told me I had mistaken him for his master, who would see me immediately. At that instant the duke came into the apartment; and I was so confused on the occasion, that I wanted words barely sufficient to express the sense I entertained of the duke's politeness, and went away extremely chagrined at the blunder I had committed."

Another feature of his character we cannot help laying before the reader. Previous to the publication of his Deserted Village, the bookseller had given him a note for one hundred guineas for the copy, which the Doctor mentioned a few hours after to one of his friends: who observed, it was a very great sum for so short a performance. "In truth," replied Goldsmith, "I think so too; I have not been easy since I received it; therefore I will go back and return him his note;" which he absolutely did; and left it entirely to the bookseller to pay him according to the profits produced by the sale of the piece, which turned out very considerable.

During the last rehearsal of his comedy intitled She stoops to Conquer, which Mr Coleman had no opinion would succeed, on the Doctor's objecting to the repetition of one of Tony Lumkin's speeches, being apprehensive it might injure the play, the manager with great keenness replied, "Psha, my dear Doctor, do not be fearful of squibs, when we have been sitting almost these two hours upon a barrel of gunpowder." The piece, however, contrary to Mr Coleman's expectation, was received with uncommon applause by the audience; and Goldsmith's pride was so hurt by the severity of the above observation, that it entirely put an end to his friendship for the gentleman that made it. Goldsmith.

Notwithstanding the great success of his pieces, by some of which it is asserted, upon good authority, he cleared 1800l. in one year, his circumstances were by no means in a prosperous situation; which was partly owing to the liberality of his disposition, and partly to an unfortunate habit he had contracted of gaming; the arts of which he knew very little of, and consequently became the prey of those who were unprincipled enough to take advantage of his simplicity.

Just before his death he had formed a design for executing an Universal Dictionary of Arts and Sciences, the prospectus of which he actually published. In this work several of his literary friends, (particularly Sir Joshua Reynolds, Dr Johnson, Mr Beauclerc, and Mr Garrick), had undertaken to furnish him with articles upon different subjects. He had entertained the most sanguine expectations from the success of it. The undertaking, however, did not meet with that encouragement from the booksellers which he had imagined it would undoubtedly receive; and he used to lament this circumstance almost to the last hour of his existence.

He had been for some years afflicted, at different times, with a violent strangury, which contributed not a little to embitter the latter part of his life; and which, united with the vexations which he suffered upon other occasions, brought on a kind of habitual despondency. In this unhappy condition he was attacked by a nervour fever, which, being improperly treated, terminated in his dissolution on the 4th of April 1774.

As to his character, it is strongly illustrated by Mr Pope's line,

In wit a man, simplicity a child.

The learned leisure he loved to enjoy was too often interrupted by distresses which arose from the liberality of his temper, and which sometimes threw him into loud fits of passion: but this impetuosity was corrected upon a moment's reflection; and his servants have been known, upon these occasions, purposely to throw themselves in his way, that they might profit by it immediately after; for he who had the good fortune to be reproved, was certain of being rewarded for it. The universal esteem in which his poems were held, and the repeated pleasure they give in the perusal, is a striking test of their merit. He was a studious and correct observer of nature; happy in the selection of his images, in the choice of his subjects, and in the harmony of his versification; and, though his embarrassed situation prevented him from putting the last hand to many of his productions, his Hermit, his Traveller, and his Deserted Village, bid fair to claim a place among the most finished pieces in the English language.

Besides the works already mentioned, he wrote, 1. History of the earth and animated nature, 6 vols 8vo. 2. History of England, 4 vols 8vo. 3. History of Rome, 2 vols. 4. Abridgements of the two last, for the

the use of schools. 5. A view of experimental philosophy, 3 vols 8vo; a posthumous work, not esteemed. 6. Miscellanies, &c.

GOLF, the name of a certain game among the Scots, and said to be peculiar to their country.—Among them it has been very ancient; for there are statutes prohibiting it as early as the year 1457, lest it should interfere with the sport of archery. It is commonly played on rugged broken ground, covered with short grass, in the neighbourhood of the sea shore. A field of this sort is in Scotland called *links*. The game is generally played in parties of one or two on each side. Each party has an exceeding hard ball, somewhat larger than a hen's egg. This they strike with a slender and elastic club, of about four feet long, crooked in the head, and having lead run into it, to make it heavy. The ball being struck with this club, will fly to the distance of 200 yards, and the game is gained by the party who puts his ball into the hole with the fewest strokes. But the game does not depend solely upon the striking of the longest ball, but also upon measuring the strength of the stroke, and applying it in such direction as to lay the ball in smooth ground, whence it may be easily moved at the next stroke. To encourage this amusement, the city of Edinburgh, A. D. 1744, gave to the company of golfers a silver club, to be played for annually by the company, the victor to append a gold or silver piece to the prize. It has been played for every year since, except the years 1746 and 1747. For their better accommodation, 22 members of the company subscribed 30l. each in the year 1768, for building a house, where their meetings might be held. The spot chosen for this purpose was the south-west corner of Leith Links, where an area was taken in feu from the magistrates of Edinburgh, and a commodious house and tavern built upon it.

GOLIUS, James, a celebrated professor of Arabic and the mathematics at Leyden, was descended from a very honourable family, and born at the Hague in the year 1596. He was put to the university of Leyden, where he studied under Erpinius; and having made himself master of all the learned languages, applied himself to the mathematics, physic, and divinity. He afterwards travelled into Africa and Asia; and became greatly esteemed by the king of Morocco, and the sultan of the Turks. He at length returned to Leyden, loaded with manuscripts; and in 1624, succeeded Erpinius in the Arabic chair. As he had been an eyewitness of the wretched state of Christianity in the Mahometan countries, he was filled with the compassion of a fellow-Christian; and none ever solicited for a place of honour and profit with greater eagerness, than he for procuring a new edition of the New Testament, in the original language, with a translation into the vulgar Greek, by an Archimandrite; and as there are some of these Christians who use the Arabic tongue in divine service, he also took care to have dispersed among them an Arabic translation of the confession of the Protestants, together with the Catechism and Liturgy. In 1626, he was also chosen professor of mathematics; and discharged the functions of both professorships with the greatest applause during 40 years. He was likewise appointed interpreter in ordinary to the states for the Arabic, Turkish, Persian, and other eastern languages, for which he had an annual pension, and a present of a gold chain, with a very beautiful medal, which he wore as a badge of his office. He published, 1. The life of Tamerlane, written in Arabic. 2. The history of the Saracens, written by Elmarin. 3. Alferganus's Elements of Astronomy, with a new version, and learned commentaries. 4. An excellent Arabic lexicon. 5. A Persian Dictionary. He died in 1667.

GOLTZIUS, Henry, a famous engraver and painter, born in 1558, at Mulbreck in the duchy of Juliers. He was taught the art of engraving by Theodore Cuerenhert; and succeeded very wonderfully in it, notwithstanding the disadvantage of a lame hand, which was occasioned by his falling into the fire whilst young. He was first employed by his master, and afterwards he worked for Philip Galle. Domestic troubles and ill health occasioned him to travel. He went through Germany into Italy; and passed under a feigned name, that his studies might not be interrupted. He visited Bologna, Florence, Naples, and Venice, constantly applying himself to drawing from the antique statues; and the works of the great masters. At Rome he resided the longest; and there he produced several excellent engravings from Polidoro Raphael, and other eminent painters. On his return to his native country he established himself at Haerlem, where he engraved many of the drawings which he had made during his abode in Italy. He died at Haerlem in 1617, aged 59. He is said to have been 40 years old before he began to paint: yet his pictures are spoken of with great commendation; but as he did not produce any great number of them, they are rarely to be met with. As an engraver, he deserves the highest commendation. No man ever surpassed, and few have equalled, him in the command of the graver and freedom of execution. He copied the style of Albert Durer, Lucas of Leyden, and other old masters, with astonishing exactness. Sometimes his engravings are neat in the extreme; at other times they are performed in a bold open manner, without the least restraint. He also engraved several of his own designs on wood, in that manner which is distinguished by the appellation of *chiaro-scuro*. Of his prints, which are very numerous, it may here suffice to specify two or three of the most celebrated: 1. Six large upright plates, known by the name of his *master-pieces*. These, it is said, he engraved to convince the public that he was perfectly capable of imitating the styles of Albert Durer, Lucan Van Leyden, and other masters, whose works were then held in higher estimation than his own: for he had adopted a new manner, which he pursued because he thought it superior, and not because he was incapable of following the others. It is reported that with one of them, the Circumcision, which he smoked to give it the more plausible air of antiquity, he actually deceived some of the most capital connoisseurs of the day; by one of whom it was bought for an original engraving of Albert Durer. The subjects of these plates are, The Annunciation of the Virgin; the Meeting of the Virgin with Elizabeth, called the Visitation; the Nativity of Christ; the Circumcision of Christ; the Adoration of the Wise Men; the Holy Family. 2. The Judgment of Midas, a large plate lengthwise. 3. The Venetian Ball, a large plate lengthwise, from Theodore Bernard. 4. The Boy and Dog, Goltzius ‖ Gombroon.

Dog, a middling-sized upright plate, from a design of his own; an admirable print. 5. The Necromancer, a middling-sized upright oval print, in chiaro-scuro. 6. Night in her Chariot, the same.

GOMBAULD, John Ogier de, one of the best French poets in the 17th century, and one of the first members of the French academy, was born at St Just de Lussac. He acquired the esteem of Mary de Medicis, and of the wits of his time. He was a Protestant, and died in a very advanced age. He wrote many works in verse and prose. His epigrams, and some of his sonnets, are particularly esteemed.

GOMBROON, by the natives called *Bander Abassi*, a city of Persia, situated in N. Lat. 27. 20. E. Long. 55. 40. The name of *Gombroon*, or *Comerong*, Captain Hamilton tells us, it had from the Portuguese; because it was remarkable for the number of prawns and shrimps caught on its coasts, by them called *comerong*. This city owes its wealth and grandeur to the demolition of Ormus, and the downfal of the Portuguese empire in the East Indies. It is now justly accounted one of the greatest marts in the East, was built by the great Shah Abas, and from him, as some think, obtained the name of *Bander Abassi*, which signifies the court of Abas. It stands on a bay about nine leagues to the northward of the east end of the island of Kishmish, and three leagues from the famous Ormus. The English began to settle here about the year 1631, when, in consideration of their services against the Portuguese, Shah Abas granted them half the customs of that port. This was confirmed by a phirmaund, and duly regarded, till the English began to neglect the services they had stipulated. Whether the company has any emolument from the customs at present, is what we cannot pretend to ascertain. The town is large, but its situation bad; wanting almost every thing that contributes to the happiness and even support of life. Towards the land it is encompassed by a sort of wall; and towards the sea are several small forts with a platform, and a castle or citadel, mounted with cannon to secure it and the road from the attempts of an enemy by sea. The houses in most of the streets are so out of repair, some half down, others in a heap of rubbish, that a stranger would imagine the town had been sacked and ravaged by a barbarous people; not a vestige of the wealth really contained in the place appearing in view. The bazars and shops round them are kept, for the most part, by Banians, whose houses are generally in good order. Most of the houses are built with earth and lime, but some of the best with stone. Many of them have a sort of ventilators at top, which contributes greatly to the health of the inhabitants in the hot seasons of the year. The most sickly months here are April, May, September, and October. With fish and mutton the inhabitants are well supplied. Rice is imported from India; and wheat is so plenty, that the poor subsist chiefly on bread and dates. The country hereabouts abounds in the most delicious fruits, as apricots, peaches, pomegranates, pears, mangoes, grapes, quavas, plums, sweet quinces, and water melons. The apricots, however, are small, and extremely dangerous if eaten to excess.

Those conveniences are more than overbalanced by the scarcity of fresh water, with which the inhabitants are supplied from Asseen, a place seven miles distant, there not being a spring or well in the town. Persons of condition keep a camel constantly employed in bringing fresh and wholesome water. Captain Hamilton gives it as his opinion, that one cause of the unwholesomeness of this city is the reflection of the rays of light from a high mountain to the north of it. He says, that when the beams are reflected from this mountain, they almost fire the air, and, for two or three months in the year, render the situation intolerable. For this reason the people of condition retire into the country, to pass the heats of June, July, and August. The very sea, during this season, is affected, insomuch that the stench is no less disagreeable than that of putrid carcases; and this is increased by the quantities of shell-fish left on the shore, from which an exhalation arises that tarnishes gold and silver, and is less tolerable than the bilge-water of a tight ship. At Asseen the English factory have a country house and gardens, to which they retire occasionally. Here they have whole groves of Seville orange trees, which, though not natural to the country, thrive very well, and are always verdant, bearing ripe and green fruit, with blossoms, all at the same time. They have likewise tanks and ponds of fine fresh water, with every thing else that can moderate the heat of the climate, and render life agreeable and elegant. About 10 miles from Asseen is a place called *Minoa*, where are cold and hot natural baths, reckoned infallible in the cure of all scrophulous disorders, rheumatisms, and other diseases, by bathing.

Gombroon ‖ Gomera.

Gombroon is extremely populous, on account of the commerce carried on by the Dutch and English factories, as well as the natives. The English factory is close by the sea, at some distance from the Dutch, which is a commodious and fine new building. A great part of the company's profits arises from freights. As the natives have not one good ship of their own, and are extremely ignorant of navigation, they freight their goods for Surat, and other Indian marts, in English and Dutch bottoms, at an exorbitant rate. The commodities of the Gombroon market are, fine wines of different kinds, raisins, almonds, kish-mishes, prunellas, dates, pistachio-nuts, ginger, silks, carpets, leather, tutty, galbanum, ammoniac, assafœtida, tragacanth, with other gums, and a variety of shop medicines. These are in a great measure the produce of Carmania, which they bring to Gombroon in caravans. The English company had once a small factory in the province of Carmania, chiefly for the sake of a fine wool produced there, and used by the hatters. The said company had once a project of carrying a breed of the Persian goats to St Helena; but whether it was executed, or what success it met with, we cannot say. Although the company pay no customs, yet they usually make a present to the shabander, to avoid the trouble he has it in his power to give them. All private traders with the company's passes, enjoy the same privileges, on paying two per cent. to the company, one to the agent, and one to the broker. All private trade, either by European or country ships, has long been engrossed by the company's servants.

GOMERA, one of the Canary islands, lying between Ferro and Teneriffe. It has one good town of the same name, with an excellent harbour, where the Spanish

Spanish fleet often taken in refreshments. It is about 20 miles long and 10 broad, and is extremely fertile, though little cultivated. It is subject to the Spaniards, who conquered it in 1445. W. Long. 17. 10. N. Lat. 28. 0.

GOMORRAH, in *Ancient Geography*, one of the cities of the plain or of the vale of Siddim in Judea, destroyed together with Sodom by fire from heaven, on account of the wickedness of the people. To determine its particular situation at present is impossible.

GOMOZIA, a genus of plants belonging to the tetrandria class. See BOTANY *Index*.

GOMPHOSIS, in *Anatomy*, that kind of articulation by which the teeth are fixed in the jaw-bone. See ANATOMY, N° 2.

GOMPHRÆNA, GLOBE AMARANTH; a genus of plants belonging to the pentandria class; and in the natural method ranking under the 54th order, *Miscellaneæ*. See BOTANY *Index*.

GONAQUA, the name of a nation inhabiting about the Cape, and supposed by Dr Sparrman to be a mixture of Hottentots and Caffres. See HOTTENTOTS.

GONDAR, the capital of Abyssinia; situated, according to Mr Bruce's observations, in latitude 12. 30. north, and longitude 57. 40. east from Greenwich. It lies upon the top of a hill of considerable height, and consists of about 10,000 families in times of peace. The houses are chiefly of clay, with roofs thatched in the form of cones. At the west end of the town is the king's palace; formerly, as Mr Bruce informs us, a structure of considerable consequence, being a large square building four stories high, flanked with square towers, and affording from the top of it a magnificent view of all the country southward to the lake Tzana. It was built in the time of Facilidas, by masons from India, and by such Abyssinians as had been instructed in architecture by the Jesuits before their expulsion. Great part of it is now in ruins, having been burnt at different times; but there is still ample lodging in the two lowest floors, the audience chamber being above 120 feet long. By the side of this structure there have been built by different kings apartments of clay only, in the fashion of their own country. The palace, with all its contiguous buildings, is surrounded by a double stone wall thirty feet high and a mile and a half in circumference, with battlements upon the outer wall, and a parapet roof between the outer and inner, by which you can go along the whole and look into the street. The hill on which the town is built rises in the middle of a deep valley, through which run two rivers: one of which, the Kakha, coming from the Mountain of the Sun, flanks all the south of the town; while the other, called the *Angrab*, falling from the mountain Woggora, encompasses it on the north and north-east; and both rivers unite at the bottom of the hill about a quarter of a mile south of the town. Upon the bank opposite to Gondar, on the other side of the river, is a large town of Mahometans; a great part of whom are employed in taking care of the king's and nobility's equipage, both when they take the field and when they return from it. They are formed into a body under proper officers; but never fight on either side, being entirely confined to the occupation just mentioned, in which by their care and dexterity in pitching and striking the tents, and in leading and conducting the baggage-waggons, they are of great service.—The valley of Gondar is described as having three outlets; one south, to Dembea, Maitsha, and the Agows; another on the north-west, towards Sennaar, from which it is distant 180 miles, over the Mountain of the Sun; and the third north, leading to Woggora, over the high mountain Lamalmon, and so on through Tigre to the Red sea.

GONDI, JOHN FRANCIS PAUL, Cardinal de Retz, was the son of Philip Emanuel de Gondi, Count de Joigny, lieutenant-general, &c. and was born in 1613. From a doctor of the Sorbonne, he first became coadjutor to his uncle John Francis de Gondi, whom he succeeded in 1654 as archbishop of Paris; and was finally made a cardinal. This extraordinary person has drawn his own character in his memoirs with impartiality. He was a man who, from the greatest degree of debauchery, and still languishing under its consequences, made himself adored by the people as a preacher. At the age of 23, he was at the head of a conspiracy against the life of Cardinal Richelieu; he precipitated the parliament into cabals, and the people into sedition: he was (says M. Voltaire) the first bishop who carried on a civil war without the mask of religion. However, his intrigues and schemes turned out so ill, that he was obliged to quit France; and he lived the life of a vagrant exile for five or six years, till the death of his great enemy Cardinal Mazarin, when he returned on certain stipulated conditions. After assisting in the conclave at Rome, which chose Clement IX. he retired from the world, and ended his life like a philosopher in 1679; which made Voltaire say, that in his youth he lived like Catiline, and like Atticus in his old age. He wrote his Memoirs in his retirement; the best edition of which is that of Amsterdam, 4 vols 12mo, 1719.

GONDOLA, a flat boat, very long and narrow, chiefly used at Venice to row on the canals. The word is Italian, *gondola*. Du Cange derives it from the vulgar Greek *κουντελας*, "a bark," or "little ship;" Lancelot deduces it from *γονδυ*, a term in Athenæus for a sort of vase.

The middle-sized gondolas are upwards of thirty feet long and four broad: they always terminate at each end in a very sharp point, which is raised perpendicularly to the full height of a man.

The address of the Venetian gondoliers, in passing along their narrow canals, is very remarkable: there are usually two to each gondola, and they row by pushing before them. The fore-man rests his oar on the left side of the gondola: the hind man is placed on the stern, that he may see the head over the tilt or covering of the gondola, and rests his oar, which is very long, on the right side of the gondola.

GONDOLA is also the name of a passage-boat of six or eight oars, used in other parts of the coast of Italy.

GONIOMETRY, a method of measuring angles, so called by M. de Lagny, who gave several papers, on this method, in the Memoirs of the Royal Academy an. 1724, 1725, 1729. M. de Lagny's method of goniometry consists in measuring the angles with a pair of compasses, and that without any scale whatever, except an undivided semicircle. Thus, having any angle drawn

drawn upon paper, to be measured; produce one of the sides of the angle backwards behind the angular point; then with a pair of fine compasses describe a pretty large semicircle from the angular point as a centre, cutting the sides of the proposed angle, which will intercept a part of the semicircle. Take then this intercepted part very exactly between the points of the compasses, and turn them successively over upon the arc of the semicircle, to find how often it is contained in it, after which there is commonly some remainder: then take this remainder in the compasses, and in like manner find how often it is contained in the last of the integral parts of the first arc, with again some remainder: find in like manner how often this last remainder is contained in the former; and so on continually, till the remainder become too small to be taken and applied as a measure. By this means he obtains a series of quotients, or fractional parts, one of another, which being properly reduced into one fraction, give the ratio of the first arc to the semicircle, or of the proposed angle to two right angles, or 180 degrees, and consequently that angle itself in degrees and minutes. *Hutton's Math. Dict.*

GONORRHOEA, an efflux of white, greenish, or differently-coloured matter, from the urethra; most commonly owing to venereal infection. See MEDICINE and SURGERY *Index*.

GONZAGA, LUCRETIA, was one of the most illustrious ladies of the 16th century; and much celebrated for her wit, her learning, and her delicate style. Hortensio Lando wrote a beautiful panegyric upon her, and dedicated to her his dialogue of moderating the passions. Her beautiful letters have been collected with the greatest care. We learn from these, that her marriage with John Paul Manfrone was unhappy.—She was married when she was not 14 years of age, and his conduct afterwards gave her infinite uneasiness. He engaged in a conspiracy against the duke of Ferrara; was detected and imprisoned by him; but, though condemned by the judges, not put to death. She did all in her power to obtain his enlargement, but in vain; for he died in prison, having shown such impatience under his misfortunes, as made it imagined he had lost his senses. She never would listen afterwards to any proposals of marriage, though several were made to her. All that came from her pen was so much esteemed, that a collection was made even of the notes she writ to her servants; several of which are to be met with in the edition of her letters.

GOOD, in general, whatever is apt to increase pleasure, to diminish pain in us; or, which amounts to the same, whatever is able to procure or preserve to us the possession of agreeable sensations, and remove those of an opposite nature.

Moral GOOD, denotes the right conduct of the several senses and passions, or their just proportion and accommodation to their respective objects and relations. See MORALS.

GOOD *Abearing* (*bonus gestus*), signifies an exact carriage or behaviour of a subject towards the king and the people, whereunto some persons upon their misbehaviour are bound: and he that is bound to this, is said to be more strictly bound than to the peace: because where the peace is not broken, the surety *de bono gestu* may be forfeited by the number of a man's company, or by their weapons.

GOOD *Behaviour*, in *Law*, an exact carriage and behaviour to the king and his people.

A justice of the peace may, at the request of another, or where he himself sees cause, demand surety for the good behaviour; and to that end the justice may issue out his warrant against any persons whatsoever, under the degree of nobility; but when it is a nobleman, complaint is to be made in the court of chancery, or king's bench, where such nobleman may be bound to keep the peace. Infants and feme-coverts, who ought to find surety by their friends, may be bound over to their good behaviour; as also lunatics, that have sometimes lucid intervals, and all others who break the peace, or being suspected to do it by affrays, assaults, battery, wounding, fighting, quarrelling, threatening, &c. A person may be likewise bound to his good behaviour for a scandalous way of living, keeping bawdy-houses, gaming-houses, &c. and so may common drunkards, whoremongers, common whores, cheats, libellers, &c. He who demands surety for the peace, on any violence offered, must take an oath before the justice, that he goes in fear of his life, or some bodily harm, &c. and that it is not out of malice, but from a regard to his own safety.

GOOD *Breeding*. See *Good* MANNERS.

GOOD *Friday*, a fast of the Christian church, in memory of the sufferings and death of Jesus Christ. It is observed on the Friday in *holy* or *passion week*; and it is called, by way of eminence, *good*, because of the blessed effects of our Saviour's sufferings, which were a propitiatory or expiating sacrifice for the sins of the world. The commemoration of our Saviour's sufferings has been kept from the very first ages of Christianity, and was always observed as a day of the strictest fasting and humiliation. Among the Saxons it was called *Long-Friday*; but for what reason, except on account of the long fastings and offices then used, is uncertain. On Good Friday the pope sits on a plain form: and, after service is ended, when the cardinals wait on him back to his chamber, they are obliged to keep a deep silence, as a testimony of their sorrow. In the night of Good-Friday, the Greeks perform the obsequies of our Saviour round a great crucifix laid on a bed of state, adorned with flowers; these the bishops distribute among the assistants when the office is ended. The Armenians, on this day, set open a holy sepulchre, in imitation of that of Mount Calvary.

GOOD *Hope*, or *Cape of Good Hope*, a promontory of Africa, with a town and a considerable territory, now subject to Britain. It is situated in the country of the Hottentots: for an account of whom, see the article HOTTENTOTS.

The Cape of Good Hope has been generally esteemed the most southerly point of Africa, though it is not truly so. In *Phillips's Voyage to Botany Bay* *, we are told, that the land which projects farthest to the south is a point to the east of it, called by the English *Cape Lagullus*; a name corrupted from the original Portuguese *das Agulhas* which, as well as the French appellation *des Aiguilles*, is descriptive of its form, and would rightly be translated *Needle cape*.

* P. 35.

On approaching the cape, a very remarkable eminence

Good Hope. nence may in clear weather be discovered at a considerable distance; and is called the *Table-mountain* from its appearance, as it terminates in a flat horizontal surface, from which the face of the rock descends almost perpendicularly. In the mild or summer season, which commences in September, and continues till March, the Table Land or Mountain, is sometimes suddenly capped with a white cloud, by some called the *spreading of the Table-cloth.* When this cloud seems to roll down the steep face of the mountain, it is a sure indication of an approaching gale of wind from the south-east; which generally blows with great violence, and sometimes continues a day or more, but in common is of short duration. On the first appearance of this cloud, the ships in Table Bay begin to prepare for it, by striking yards and top-masts, and making every thing as snug as possible.—A little to the westward of the Table Land, divided by a small valley, stands on the right-hand side of Table Bay a round hill, called the *Sugar Loaf;* and by many the *Lion's Head,* as there is a continuance from it contiguous to the sea, called the *Lion's Rump;* and when you take a general view of the whole, it very much resembles that animal with his head erect. The Sugar Loaf or Lion's Head, and the Lion's Rump, have each a flag staff on them, by which the approach of ships is made known to the governor, particularizing their number, nation, and the quarter from which they come. To the eastwards, separated by a small chasm from the Table Land, stands Charles's Mount, well known by the appellation of the *Devil's Tower,* or *Devil's Head;* and so called from the violent gusts of wind supposed to issue from it when it partakes of the cap that covers the Table Land, though these gusts are nothing more than a degree of force the wind acquires in coming through the chasm. When this phenomenon appears in the morning, which is by no means so frequent as in the evening, the sailors have a saying, as the Devil's Tower is almost contiguous to the Table Land, that the old gentleman is going to breakfast; if in the middle of the day, that he is going to dinner; and if in the evening, that the cloth is spread for supper. Table-mountain rises about 3567 feet above the level of the sea; the Devil's Tower, about 3368; and the Lion's Head, 2764. In the neighbourhood of the latter lies *Constantia,* a district consisting of two farms, wherein the famous wines of that name are produced.

The above-described high lands form a kind of amphitheatre about the Table-valley, where the Cape-town stands. This is situated at the bottom of the middle height, or Table-mountain; and almost in the centre of the Table Bay, so called from that mountain.—This bay, it is observed in Phillips's Voyage, "cannot properly be called a port, being by no means a station of security; it is exposed to all the violence of the winds which set into it from the sea; and is far from sufficiently secured from those which blow from the land. The gusts which descend from the summit of Table-mountain are sufficient to force ships from their anchors, and even violently to annoy persons on the shore, by destroying any tents or other temporary edifices, which may be erected, and raising clouds of fine dust, which produce very troublesome effects. A gale of this kind, from the south-east, blew for three days successively when Captain Cook lay here in his first voyage; at which time, he informs us, the Resolution was the only ship in the harbour that had not dragged her anchor. The storms from the sea are still more formidable; so much so, that ships have frequently been driven by them from their anchorage, and wrecked at the head of the bay. But these accidents happen chiefly in the *quaade mousson,* or winter months, from May 14th to the same day of August; during which time few ships venture to anchor here. Our fleet arriving later, lay perfectly unmolested as long as it was necessary for it to remain in this station.—False Bay, on the south-east side of the Cape, is more secure than Table Bay during the prevalence of the north-west winds, but still less so in strong gales from the south-east. It is, however, less frequented, being 24 miles of very heavy road distant from Cape Town, whence almost all necessaries must be procured. The most sheltered part of False Bay is a recess on the west side, called *Simon's Bay.*"

Mr White, in his Journal of a Voyage to New South Wales, thus describes Cape Town. From the shipping, he observes *, the town appears pleasantly situated, but at the same time small; a deception that arises from its being built in a valley with such stupendous mountains directly behind it. On landing, however, you are surprised, and agreeably disappointed, to find it not only extensive, but well built, and in a good style; the streets spacious, and intersecting each other at right angles with great precision. This exactness in the formation of the streets, when viewed from the Table Land, is observed to be very great. The houses in general are built of stone, cemented together with a glutinous kind of earth which serves as mortar, and afterwards neatly plastered and whitewashed with lime. As to their height they do not in common exceed two stories, on account of the violence of the wind, which at some seasons of the year blows with great strength and fury. For the same reason thatch has been usually preferred to tiles or shingles; but the bad effects that have proceeded from this mode when fires happen, has induced the inhabitants in all their new buildings to give the preference to slates and tiles. The lower parts of the houses, according to the custom of the Dutch nation, are not only uncommonly neat and clean in appearance, but they are really so; and the furniture is rather rich than elegant. But this is by no means the case with the bed-rooms or upper apartments; which are very barely and ill furnished. The streets are rough, uneven, and unpaved. But many of the houses have a space flagged before the door; and others have trees planted before them, which form a pleasant shade, and give an agreeable air to the streets.

* Page 87.

The only landing-place is at the east end of the town, where there is a wooden quay running some paces into the sea, with several cranes on it for the convenience of loading and unloading the scoots that come alongside. To this place excellent water is conveyed by pipes, which makes the watering of ships both easy and expeditious. Close to the quay, on the left hand, stands the castle and principal fortress; a strong extensive work, having excellent accommodations for the troops, and for many of the civil officers belonging to the company. Within the gates, are the principal stores; which are spacious as well as convenient. This fort covers and defends the east part of the town and harbour

Good Hope. bour, as Amsterdam fort does the west part. The latter, which has been built since Commodore Johnston's expedition, and whereon both French and Dutch judgment have been united to render it effectual and strong, is admirably planned and calculated to annoy and harass ships coming into the bay. Some smaller detached fortifications extend along the coast, both to the east and west, and make landing, which was not the case before the late war, hazardous and difficult. In a word, Cape Town is at this time fortified with strength, regularity, and judgment. It consists of 1145 houses, inhabited by about 5500 whites and people of colour, and 10,000 blacks.

There are two churches in the town; one large, plain, and unadorned, for the Calvinists, the prevailing sect; and a smaller one for the Lutherans. The hospital, which is large and extensive, is situated at the upper end of the town, close to the company's garden; where the convalescents reap the benefit of a wholesome pure air, perfumed with the exhalations of a great variety of rich fruit trees, aromatic shrubs, and odorous plants and flowers; and likewise have the use of every production of it.

The territory round the Cape is distinguished by three chains of mountains, running parallel to one another and to the coast. The first chain, called Lange Kloof, or Long Pass, runs parallel to the southern coast, at the distance of from 20 to 60 miles, widening towards the west. The second chain, called Zwarte Berg, or Black Mountain, is considerably higher and more rugged than the first, and consists often of double or triple ranges. The belt interposed between the Zwarte Berg and the Lange Kloof is nearly of the same breadth as that between the Lange Kloof and the sea, and is considerably more elevated. Beyond the Zwarte Berg, at an interval of 80 or 100 miles, rises the Nieuweldts Gebirg, the highest chain in southern Africa, and the summits of which are generally covered with snow. Its elevation is supposed to be 10,000 feet. The belt or plain interposed between the two last ridges is more elevated than any of the former, so that southern Africa forms as it were a succession of terraces rising above one another. The plain next the sea is covered with a deep and fertile soil, watered by numerous rivulets, well clothed with grass and with a beautiful varicty of trees and shrubs. Rains are frequent, and from its proximity to the sea, it enjoys a more mild and equable temperature than the interior and remoter parts of the colony. The second terrace contains a considerable proportion of well watered and fertile lands, but these are mixed with large tracts of the arid desert called Karroo. The third terrace, called the Great Karroo, is composed of a vast plain 300 miles in length, and nearly 100 in breadth, the soil of which is of a hard and impenetrable texture, and destitute almost of any trace of vegetation.

It is obvious, from this outline, that a large portion of the settlement must be devoted to complete and hopeless sterility. The Karroo, of which the greatest part of the second, and the whole of the third and largest belt is composed, is quite unoccupied by man or animal. Only a few shrivelled and parched plants occasionally meet the eye, faintly extending their half withered fibres along the ground. The surface consists of clay, thinly sprinkled over with sand, and is scarcely ever moistened with a shower of rain. The hills, which sometimes break the surface of these plains, are equally destitute of plants as the plain beneath. The upper regions of all the chains of mountains consist of masses of naked sandstone. Mr Barrow, in short, concludes, that seven-tenths of the settlement for a great part of the year, and a large proportion of it at all times, is destitute of the least appearance of verdure. The climate of the Cape is besides subject to various disadvantages. It is deluged with rain during the cold season; while, in the hot months, scarcely a shower falls to refresh the earth. During this season also a dry wind blows, having the pernicious effects of the African sirocco, blasting vegetation, and relaxing the human frame. Tempestuous winds are besides extremely common, and often uproot trees and destroy the the crops. There are, however, many spots about the Cape of extreme fertility. But the want of roads, or other means of transporting commodities, renders the good soil often of no value. The Cape town is supplied with grain from places generally at more than *one* and less than *three* days' journey distant. Beyond that, ground can only be applied to the purpose of grazing with advantage.

Wine and brandy are the staple produce of the Cape. The Constantia wine, raised only on two farms, is pretty much esteemed; but the mode of management is far too rude and slovenly to produce good wine generally; and notwithstanding the encouragement given to the Cape wines, by diminishing the duties, they are not relished in Britain. Some attempts, it is understood, are now making to improve the processs of manufacture. Tobacco, aloes, with almonds, and fruits of almost all kinds, succeed extremely well, but are not much cultivated. Attempts are now making to colonize the country round the Cape with British settlers; time can only shew whether it will succeed.

The inhabitants of the Cape, though in their persons large, stout, and athletic, have not all that phlegm about them which is the characteristic of Dutchmen in general. The physical influence of climate may in some degree account for this; for it is well known that in all southern latitudes the temper and disposition of the people are more gay, and that they are more inclined to luxury and amusements of every kind, than the inhabitants of the northern hemisphere. The ladies are lively, good natured, and familiar; and from a peculiar gay turn, they admit of liberties that would be thought reprehensible in England, shough perhaps they as seldom overleap the bounds of virtue as the women of other countries.

The heavy draft work about the Cape is mostly performed by oxen; which are here brought to an uncommon degree of usefulness and docility. It is not uncommon to see 14, 16, and sometimes 18, in one of their teams; when the roads are heavy, they sometimes, though rarely, yoke 20; all which the Hottentots, Malays, and Cape slaves, have in the most perfect subjection and obedience. One of these fellows places himself on the fore part of the waggon, or, when loaded, on the top of the load, and with a tremendous long whip, which from its size he is obliged to hold in both his

his hands, manages these creatures with inexpressible address. When he finds expedition needful, he can make them keep whatever pace he chooses, either trot or gallop, (a gait performed or kept up with difficulty by European oxen), and that with as much ease as if he was driving horses. They likewise manage horses with the same dexterity; and to see one of them driving three, four, five, and sometimes six pair, in hand, with one of these long whips, would make the most complete master of the whip in England cut a despicable figure. Carriages are not very numerous at the Cape, as the inhabitants in general travel in covered waggons, which better suit the roughness of the country. The governor and some few of the principal people keep coaches, which are a good deal in the English style, and always drawn by six horses.

Its geographical position on the globe is so commanding a feature, that the mere looking at a map, independent of any other information, must shew its value and importance in various respects. Its distance from the coast of Brazil is a month's voyage; from the Dutch colonies of Surinam, Berbice, and Essequibo, it is a voyage of six weeks; it is about equally distant from the Red sea, and two months from Coromandel and Malabar. It is half way between Britain and India, in a temperate climate, and productive of every species of refreshment in great abundance.

Considered in the light of a naval station, the importance of the Cape is equally conspicuous. It may serve as a port for refreshing and refitting the ships of the East India Company; a station for ships of war keeping the entrance into the Indian seas, and affording, by its geographical position, a ready communication with every part of the globe. There is no place, in the homeward bound voyage from India, so proper or convenient for East India ships to assemble at for convoy, as the Cape of Good Hope. Their crews might be refreshed with fruits, vegetables, and fresh provisions, at a very reasonable rate. Salt beef for the remainder of the voyage might there be laid in. An establishment for curing salt provisions, would be an incalculable saving, as well as a singular convenience. The moderate expence at which a fleet could here be maintained, is a circumstance that deserves attention. At the Cape a sailor may be furnished his ration of fresh beef or mutton, biscuit and wine, for one-fourth of what the same ration of salt beef costs the government when sent out from Britain.

If a naval establishment was formed at Saldanha bay, many coasting vessels and fishing ships would be constructed in it, as it abounds with every convenience that could be required for building ships, which would be the means of very much increasing the coasting trade.

It is thought also, that were a depot for the southern whale fishery established at the Cape, it might be attended with beneficial consequences. By promoting navigation, the strength and security of the British empire are also promoted, and its very existence as an independent nation is owing to the superiority of its navy. A nation of fishermen implies a nation of seamen, a race of bold and hardy warriors. The cultivation of the fisheries would afford a never-failing supply of men so instructed, increase our conveniency, and promote our commerce.

The colony of the Cape comprehends at least 120,000 square miles; yet the whole population of whites, blacks, and Hottentots, does not exceed 60,000 souls, or a single individual for every two square miles. The rural occupants may be divided into the wine-growers, the corn-farmers, and the graziers. The first, who reside in the immediate vicinity of the Cape, are the most civilized and comfortably situated of the peasantry. Their property is usually about 120 acres in extent, and held in freehold. The corn-boors or farmers, reside generally at the distance of two or three days journey from the Cape. The agriculture is extremely rude. Their plough, an unwieldy machine, drawn by 14 or 16 oxen, does little more than skim the surface. They use almost no manure, and tread out the corn by the feet of horses. The grazier is the least cultivated, and indeed is half a savage. All these classes employ Hottentots, who are not slaves, strictly speaking, but in a condition nearly as bad.

Good Manners. See Manners.

GOOINGS, in sea-language, are clamps of iron bolted on the stern-post of a ship, whereon to hang the rudder and keep it steady; for which purpose there is a hole in each of them, to receive a correspondent spindle bolted on the back of the rudder, which turns thereby as upon hinges.

GOOSE. See Anas, Ornithology *Index*. The goose was held in great esteem amongst the Romans for having saved the Capitol from the invasion of the Gauls by cackling and clapping its wings. Geese were kept in the temple of Juno; and the censors, when they entered upon their office, provided meat for them. There was also an annual feast at Rome, at which they carried a silver image of a goose in state; and hanged a dog, to punish that animal because he did not bark at the arrival of the Gauls.

Goose-Ander. See Mergus, Ornithology *Index.*

Goose-Berry. See Ribes, Botany *Index.*

Goose-Neck, in a ship, a piece of iron fixed on the one end of the tiller, to which the laniard of the whip-staff or the wheel-rope comes, for steering the ship.

Goose-Wing, in the sea language. When a ship sails before, or with a quarter-wind on a fresh gale, to make the more haste, they launch out a boom and sail on the lee-side; and a sail so fitted is called a *goose-wing*.

GORCUM, a town in South Holland, which carries on a considerable trade in cheese and butter. It is situated on the rivers Ligne and Maese, in E. Long. 4. 55. N. Lat. 51. 49.

GORDIANUS I. a Roman general, was for his valour and virtues chosen emperor by the army in the reign of Maximinus, A. D. 237; but his son, whom he had associated with himself in the throne, being slain by Capellian, the governor of Mauritania for Maximinus, Gordianus killed himself the same year. See Rome.

Gordianus III. grandson of the former, a renowned warrior, and styled *The guardian of the Roman commonwealth.* He was treacherously assassinated by Philippus, an Arabian, one of his generals; who, to the eternal disgrace of the Romans of that era, succeeded him in the empire, A. D. 244. See Rome.

GORDIAN-knot,

GORDIAN-KNOT, in antiquity, a knot made in the leathers or harness of the chariot of Gordius king of Phrygia, so very intricate, that there was no finding where it began or ended. The inhabitants had a tradition, that the oracle had declared, that he who untied this knot should be master of Asia. Alexander having undertaken it, was unable to accomplish it; when fearing lest his not untying it should be deemed an ill augury, and prove a check in the way of his conquests, he cut it asunder with his sword, and thus either accomplished or eluded the oracle.

GORDIUS, the HAIR-WORM, a genus of insects belonging to the class of *vermes intestina*. See HELMINTHOLOGY *Index*.

GORDIUS, king of Phrygia, and father of Midas, was a poor husbandman, with two yokes of oxen, wherewith he ploughed his land and drew his wain. An eagle sitting a long while upon one of his oxen, he consulted the soothsayers; a virgin bid him sacrifice to Jupiter in the capacity of king. He married the virgin, who brought forth Midas. The Persians, instructed by the oracle to set the first person they met in a wain upon the throne, met Gordius, and made him king. Midas for this good fortune dedicated to Jupiter his father's cart, The knot of the yoke, they say, was so well twisted, that he who could unloose it was promised the empire of Asia; hence the proverb of *the Gordian knot* had its original. See *GORDIAN KNOT*.

GORDON, ALEXANDER, an excellent draughtsman, and a good Greek scholar, who resided many years in Italy, visited most parts of that country, and had also travelled into France, Germany, &c. was secretary to the Society for Encouragement of Learning; and afterwards to the Egyptian Club, composed of gentlemen who had visited Egypt, viz. Lord Sandwich, Dr Shaw, Dr Pococke, &c. He succeeded Dr Stukeley as secretary to the Antiquarian Society, which office he resigned in 1741 to Mr Joseph Ames. He went to Carolina with Governor Glen, where, besides a grant of land, he had several offices, such as register of the province, &c.; and died a justice of the peace, leaving a handsome estate to his family. He published, 1. *Itinerarium Septentrionale*, or a Journey through most parts of the Counties of Scotland, in two parts, with 66 copperplates, 1726, folio. 2. Supplement to the *Itinerarium*, 1732, folio. 3. The Lives of Pope Alexander VI. and his son Cæsar Borgia. 4. A complete History of the Ancient Amphitheatres, 1730, 8vo. afterwards enlarged in a second edition. 5. An Essay towards explaining the hieroglyphical figures on the Coffin of the ancient Mummy belonging to Captain William Lethieulier, 1737, folio, with cuts. 6. Twenty-five Plates of all the Egyptian Mummies and other Egyptian Antiquities in England, 1739, folio.

GORDON, *Thomas*, noted for his translations and political writings, was born at Kirkcudbright in North Britain. He came young to London; where he supported himself by teaching languages, until he procured employment under the earl of Oxford in Queen Anne's time, but in what capacity is not now known. He first distinguished himself in the defence of Dr Hoadley in the Bangorian controversy; which recommended him to Mr Trenchard, in conjunction with whom he wrote the well-known Cato's Letters, upon a variety of important public subjects. These were followed by another periodical paper, under the title of the Independent Whig; which was continued some years after Mr Trenchard's death, by Gordon alone, against the hierarchy of the church; but with more acrimony than was shown in Cato's Letters. At length Sir Robert Walpole retained him to defend his administration, to which end he wrote several pamphlets. At the time of his death, July 28th 1750, he was first commissioner of the wine licenses, an office which he had enjoyed many years. He was twice married. His second wife was the widow of his great friend Trenchard, by whom he had children.—He published English translations of Sallust and Tacitus, with additional discourses to each author, which contain much good matter. Also, two collections of his tracts have been preserved: the first entitled, A Cordial for Low-spirits, in three volumes: and the second, The Pillars of Priestcraft and Orthodoxy shaken, in two volumes. But these, like many other posthumous things, had better have been suppressed. In his translations as well as his other works he places his verbs at the ends of sentences, according to the Latin idiom, in a very stiff and affected manner.

GORDONIA, a genus of plants, belonging to the monadelphia blass. See BOTANY *Index*.

GORE, in *Heraldry*, one of the abatements, which, according to Guillim, denotes a coward. It is a figure consisting of two arch lines drawn one from the sinister chief, and the other from the sinister base, both meeting in an acute angle in the middle of the fess point. See HERALDRY.

GOREE, a small island of Africa, near Cape de Verd, subject to the French. It is a small spot not exceeding two miles in circumference, but its importance arises from its situation for trade so near Cape Verd, and it has been therefore a bone of contention between European nations. It was first possessed by the Dutch, from whom, in 1663, it was taken by the English; but in 1665 it was retaken by the Dutch, and in 1677 subdued by the French, in whose possession it remained till the year 1759, when the British arms were everywhere triumphant; and it was reduced by Commodore Keppel, but restored to the French at the treaty of peace in 1763. It was retaken by the English in the American war, but again restored at the peace of 1783. E. Long. 17. 20. N. Lat. 14. 43.

GOREE, the capital town of an island of the same name in Holland, eight miles south of Briel. E. Long. 3. 50. N. Lat. 51. 55.

GOREY, a borough, fair, and post-town in the county of Wexford, province of Leinster, otherwise called *Newborough*. It stands about 18 miles north of Wexford town, and 45 from Dublin. N. Lat. 52. 40. W. Long. 6. 30. It sent formerly two members to the Irish parliament.

GORGE, in *Architecture*, the narrowest part of the Tuscan and Doric capitals, lying between the astragal, above the shaft of the pillar, and the annulets.

GORGE, in *Fortification*, the entrance of the platform of any work. See FORTIFICATION.

GORGED, in *Heraldry*, the bearing of a crown, coronet, or the like, about the neck of a lion, a swan, &c.

&c. and in that case it is said, the lion or cygnet is gorged with a ducal coronet, &c.

GORGED is also used when the gorge or neck of a peacock, swan, or the like bird, is of a different colour or metal from the rest.

GORGET, a kind of breast-plate, like a half-moon, with the arms of the prince thereon; worn by the officers of foot. They are to be either gilt or silver, according to the colour of the buttons on the uniforms.

GORGET, or GOGERET, in *Surgery*, is the name which the French give to the concave or cannulated conductor, used in lithotomy. See SUGERY *Index*.

GORGONA, a small island of Italy, in the sea of Tuscany, and near that of Corsica, about eight miles in circumference; remarkable for the large quantity of anchovies taken near it. E. Long. 10. 0. N. Lat. 43. 22.

GORGONA, a small island of the South sea, 12 miles west of the coast of Peru, in America. It is indifferent high land, very woody, and some of the trees are very tall and large, and proper for masts. It is about 10 miles in circumference, and has several springs and rivulets of excellent water, but is subject to constant rains. W. Long. 73. 3. S. Lat. 30.

GORGONIA, in *Natural History*, a genus of zoophytes, which formerly were called *ceratophytons*, and are known in English by the names of *sea-fans*, *sea-feathers*, and *sea-whips*. Linnæus and Dr Pallas consider them as of a mixed nature in their growth, between animals and vegetables; but Mr Ellis shows them to be true animals of the polype kind, growing up in a branched form resembling a shrub, and in no part vegetable. They differ from the fresh water polype in many of their qualities, and particularly in producing from their own substance a hard and solid support, serving many of the purposes of the bone in other animals. This is formed from a concreting juice thrown out from a peculiar set of longitudinal parallel tubes, running along the internal surface of the fleshy part: in the coats of these tubes are a number of small orifices, through which the osseous liquor exudes, and concreting, forms the layers of that hard part of the annular circles, which some, judging from the consistence rather than the texture, have erroneously denominated *wood*. The surface of the gorgonia is composed of a kind of scales, so well adapted to each other as to serve for defence from external injuries: and the flesh, or, as some have called it, the *bark* or *cortex*, consists of proper muscles and tendons for extending the openings of their cells; for sending forth from thence their polype suckers in search of food; and for drawing them in suddenly, and contracting the sphincter muscles of these starry cells, in order to secure these tender parts from danger; and also of proper secretory ducts, to furnish and deposit the osseous matter that forms the stem and branches as well as the base of the bone. Mr Ellis affirms, that there are ovaries in these animals, and thinks it very probable that many of them are viviparous. See ZOOPHYTES.

GORGONS, in *Antiquity* and *Mythology*. Authors are not agreed in the account they give of the Gorgons. The poets represent them as three sisters, whose names were *Stheno*, *Euryale*, and *Medusa;* the latter of whom was mortal, and, having been deflowered by Neptune, was killed by Perseus; the two former were subject neither to age nor death. They are described with wings on their shoulders, with serpents round their heads, their hands were of brass, and their teeth of a prodigious size, so that they were objects of terror to mankind. After the death of Medusa, her sisters, according to Virgil, were appointed to keep the gate of the palace of Pluto.

Multaque præterea variarum monstra ferarum—
GORGONES, Harpyiæque——

Diodorus Siculus will have the Gorgons and Amazons to have been two warlike nations of women, who inhabited that part of Libya which lay on the lake Tritonidis. The extermination of these female nations was not effected till Hercules undertook and performed it.

Pausanias says, the Gorgons were the daughters of Phorbus; after whose death, Medusa, his daughter, reigned over the people dwelling near the lake Tritonidis. The queen was passionately fond of hunting and war, so that she laid the neighbouring countries quite waste. At last, Perseus having made war on them, and killed the queen herself, when he came to take a view of the field of battle, he found the queen's corpse so extremely beautiful, that he ordered her head to be cut off, which he carried with him to show his countrymen the Greeks, who could not behold it without being struck with astonishment.

Others represent them as a kind of monstrous women, covered with hair, who lived in woods and forests. Others, again, make them animals, resembling wild sheep, whose eyes had a poisonous and fatal influence.

GORITIA, or GORITZ, a strong town of Germany, in the circle of Anstria, and duchy of Carniola, with a castle; seated on the river Lizonzo, 20 miles north-east of Aquileia, and 70 north-east of Venice. E. Long. 13. 43. N. Lat. 46. 12.

GORLÆUS, ABRAHAM, an eminent antiquary, was born at Antwerp, and gained a reputation by collecting medals and other antiques. He was chiefly fond of the rings and seals of the ancients, of which he published a prodigious number in 1601, under this title, *Dactyliotheca; sive Annulorum Sigillarium, quorum apud priscos tam Græcos quam Romanos usus ex ferro, ære, argento, et auro, Promptuarium.* This was the first part of the work: the second was entitled, *Variarum Gemmarum, quibus antiquitas in signando uti solita sculpturæ.* This work has undergone several editions, the best of which is that of Leyden, 1695: for it not only contains a vast number of cuts, but also a short explication of them by Gronovius. In 1680, he published a collection of medals: which, however, if we may believe the *Scaligerana*, it is not safe always to trust. Gorlæus pitched upon Delft for the place of his residence, and died there in 1609. His collections of antiques were sold by his heirs to the prince of Wales.

GORLITZ, a town of Germany, in Upper Lusatia, now subject to Prussia. It is a handsome strong place, and seated on the river Neisse, in E. Long. 15. 15. N. Lat. 51. 10.

GORTERIA, a genus of plants belonging to the syngenesia class, and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

GOSHAWK. See FALCO, ORNITHOLOGY *Index*.

GOSHEN,

GOSHEN, in *Ancient Geography*, a canton of Egypt, which Joseph procured for his father and his brethren when they came to dwell in Egypt. It was the most fruitful part of the country: and its name seems to be derived from the Hebrew, *Geshem*, which signifies "rain;" because this province lying very near the Mediterranean, was exposed to rains, which were very rare in other cantons, and more especially in Upper Egypt. Calmet does not question but that Goshen, which Joshua (x. 41. xi. 16. xv. 51.) makes part of the tribe of Judah, is the same as the land of Goshen, which was given to Jacob and his sons by Pharaoh king of Egypt; (Gen. xlvi. 28.). It is certain that this country lay between Palestine and the city of Tanais, and that the allotment of the Hebrews reached southward as far as the Nile, (Josh. xiii. 3.).

GOSLAR, a large and ancient town of Lower Saxony, and in the territory of Hildesheim. It was here that gunpowder was first invented, by a monk as is generally supposed. It is a large place, but the buildings are in the ancient taste. It was formerly a free city, but was given to Prussia in 1802, and ceded by that power to Hanover in 1814. It is seated on a mountain, near the river Gose, and near it are rich mines of iron. The inhabitants are famous for brewing excellent beer. E. Long. 10. 26. N. Lat. 51. 55.

GOSPEL, the history of the life, actions, death, resurrection, ascension, and doctrine of Jesus Christ.—The word is Saxon, and of the same import with the Latin term *evangelium*, which signifies "glad tidings," or "good news."

This history is contained in the writings of St Matthew, St Mark, St Luke, and St John; who from thence are called *evangelists*. The Christian church never acknowledged any more than these four gospels as canonical; notwithstanding which, several apocryphal gospels are handed down to us, and others are entirely lost.

GOSPORT, a town of Hampshire, 79 miles from London, in the parish of Alverstock. It has a ferry over the mouth of the harbour to Portsmouth, and is a large town and of great trade, especially in time of war. Travellers choose to lodge here, where every thing is cheaper and more commodious for them than at Portsmouth. The mouth of the harbour, which is not so broad here as the Thames at Westminster, is secured on this side by four forts, and a platform of above 20 cannon level with the water. Here is a noble hospital built for the cure of the sick and wounded sailors in the service of the navy; besides a free school.

GOSSAMER is the name of a fine filmy substance, like cobwebs, which is seen to float in the air, in clear days in autumn, and is more observable in stubble-fields, and upon furze and other low bushes. This is probably formed by the flying spider, which, in traversing the air for food, shoots out these threads from its anus, which are borne down by the dew, &c.

GOSSYPIUM, or COTTON, a genus of plants belonging to the monadelphia class, and in the natural method ranking under the 37th order, *Columniferæ*. See BOTANY *Index*.

The American islands produce cotton shrubs of various sizes, which rise and grow up without any culture; especially in low and marshy grounds. Their

produce is of a pale red; some paler than others; but so short that it cannot be spun. None of this is brought to Europe, though it might be usefully employed in making of hats. The little that is picked up, serves to make mattresses and pillows.

The cotton-shrub that supplies our manufactures, requires a dry and stony soil, and thrives best in grounds that have already been tilled. Not but that the plant appears more flourishing in fresh lands than in those which are exhausted; but while it produces more wood, it bears less fruit.

A western exposure is fittest for it. The culture of it begins in March and April, and continues during the first spring-rains. Holes are made at seven or eight feet distance from each other, and a few seeds thrown in. When they are grown to the height of five or six inches, all the stems are pulled up, except two or three of the strongest. These are cropped twice before the end of August. This precaution is the more necessary, as the wood bears no fruit till after the second pruning; and, if the shrub was suffered to grow more than four feet high, the crop would not be the greater, nor the fruit so easily gathered. The same method is pursued for three years; for so long the shrub may continue, if it cannot conveniently be renewed oftener with the prospect of an advantage that will compensate the trouble.

This useful plant will not thrive if great attention is not paid to pluck up the weeds that grow about it. Frequent rains will promote its growth; but they must not be incessant. Dry weather is particularly necessary in the months of March and April, which is the time of gathering the cotton, to prevent it from being discoloured and spotted.

When it is all gathered in, the seeds must be picked out from the wool with which they are naturally mixed. This is done by means of a cotton-mill; which is an engine composed of two rods of hard wood, about 18 feet long, 18 lines in circumference, and fluted two lines deep. They are confined at both ends, so as to leave no more distance between them than is necessary for the seed to slip through. At one end is a kind of little millstone, which, being put in motion with the foot, turns the rods in contrary directions. They separate the cotton, and throw out the seed contained in it.

GOTHA, a town of Germany, in the circle of Upper Saxony, and capital of the duchy of Saxe-Gotha, in E. Long. 10. 40. N. Lat. 50. 57. Some fancy this town had its name from the Goths, and that they fortified it in their march to Italy; but it was only a village till surrounded with walls by the bishop of Mentz in 964. It is situated in a fine plain on the river Leina, well built and strongly fortified. Here are two handsome churches and a very good hospital. Its chief trade is in dyers weed, of which they have three crops, but the third grows wild. The neighbouring country produces a vast deal of corn. The castle or ducal palace of Gotha was rebuilt in the 16th century by duke Ernest, surnamed *the Pious*, who caused both that and the town to be encompassed with ditches and ramparts; and gave it the name of *Friedenstein*, or the *Castle of Peace*, in opposition to its ancient name of *Grimmerstein*, or the *Castle of the Furies*. It is situated on a neighbouring eminence, from whence there is a vast prospect of a fruitful plain. In one of the apartments there is a collection of valuable rarities, and a noble library. The town has 11,600 inhabitants.

The dukedom of Saxe Gotha is about 30 miles long, and 20 broad. It contains an area of about 500 square miles, and its population is estimated at 82,000. The duke is the head of the Ernestine line of Saxony, descended from the elector John Frederick the Magnanimous, who was deprived of the electorate by the emperor Charles V. in 1574; since which the youngest branch, called the *Albertine*, has enjoyed it. He has several other principalities besides that of Saxe Gotha; and his revenues are computed at 150,000l. a-year, with which he maintains about two thousand regular troops. As he is the most powerful of all the Saxon princes of the Ernestine branch; so of all the courts of Saxony, next to that of Dresden, he has the most numerous and the most magnificent. His guards are well clothed, his liveries rich, and his tables served with more elegance than profusion. And yet by the prudent management of his public finances, his subjects are the least burdened with taxes of any state in Germany. The religion is Lutheran.

GOTHARD, one of the highest mountains of Switzerland; and from the top, where there is an hospital for monks, is one of the finest prospects in the world. It is eight miles from Aldorf.

GOTHEBORG, Gothenburg, or *Gottenburg*. See Gottenburg.

GOTHIC, in general, whatever has any relation to the Goths: thus we say, Gothic customs, Gothic architecture, &c. See Architecture.

GOTHLAND, the most southern province of Sweden, being a peninsula, encompassed on three sides by the Baltic sea, or the channel at the entrance of it. It is divided into several parts, which are, East Gothland, West Gothland, Smaland, Halland, Bleaking, and Schonen. It was a long time in the possession of the kings of Denmark, but was ceded to Sweden in 1654. The principal towns of Gothland are Calmar, Landscroon, Christianople, Daleburg, Gothenburgh, Helmstat, Lunden, Malmone, and Vexio.

GOTHS, a warlike nation, and above all others famous in the Roman history, came originally out of Scandinavia (the name by which the ancients distinguished the present countries of Sweden, Norway, Lapland, and Finmark). According to the most probable accounts they were the first inhabitants of those countries; and from thence sent colonies into the islands of the Baltic, the Cimbrian Chersonesus, and the adjacent places yet destitute of inhabitants. The time of their first settling in Scandinavia, and the time when they first peopled with their colonies the above-mentioned islands and Chersonesus, are equally uncertain; though the Gothic annals suppose the latter to have happened in the time of Serug the great grandfather of Abraham. This first migration of the Goths is said to have been conducted by their king Eric; in which all the ancient Gothic chronicles, as well as the Danish and Swedish ones, agree. Their second migration is supposed to have happened many ages after; when, the above-mentioned countries being overstocked with people, Berig, at that time king of the Goths, went out with a fleet in quest of new settlements. He landed in the country of the Ulmerugians, now Pomerania, drove out the ancient inhabitants, and divided their lands among his followers. He fell next upon the Vandals, whose country bordered on that of the Ulmerugians, and overcame them; but instead of forcing them to abandon their country, he only made them share their possessions with the Goths.

The Goths who had settled in Pomerania and the adjacent parts of Germany being greatly increased, insomuch that the country could no longer contain them, they undertook a third migration in great numbers, under Filimer surnamed the *Great*, the fifth prince after leaving Scandinavia; and taking their route eastward, entered Scythia, advanced to the Cimmerian Bosphorus, and driving out the Cimmerians, settled in the neighbourhood of the Palus Mæotis. Thence, in process of time, being greatly increased in Scythia, they resolved to seek new settlements; and accordingly taking their route eastward, they traversed several countries, and at length returned into Germany.

Their leader in this expedition was the celebrated Woden, called also *Voden*, *Othen*, *Oden*, *Godan*, and *Guadan*. Of this Woden many wonderful things are related in the Sueo-gothic chronicles. He was king of the Asgardians, whom the northern writers will have to be the same with a people called *Aspurgians* mentioned by Strabo and Ptolemy. By Strabo they are placed near the Cimmerian Bosphorus. Aspurgia was the metropolis of a province which Strabo calls *Asia;* and Woden and his followers are styled by the ancient Gothic writers *Asæ*, *Asianæ*, and *Asiotæ*. The kings of Aspurgia were masters of all that part of Scythia which lay to the westward of Imaus, and was by the Latins called *Scythia intra Imaum*, or "Scythia within Imaus."

At what time Woden reigned in this country, is quite uncertain; but all historians agree, that he went out in quest of new settlements with incredible numbers of people following him. He first entered Roxolania, comprehending the countries of Prussia, Livonia, and great part of Muscovy. From thence he went by sea into the north parts of Germany; and having reduced Saxony and Jutland, he at last settled in Sweden, where he reigned till his death, and became so famous that his name reached all countries, and he was by the northern nations worshipped as a god. He is supposed to have brought with him the Runic characters out of Asia, and to have taught the northern nations the art of poetry; whence he is styled the father of the Scaldi or Scaldri, their poets, who described in verse the exploits of the great men of their nation, as the bards did among the Gauls and Britons.

The Romans distinguished the Goths into two classes; the Ostrogoths and Visigoths. These names they received before they left Scandinavia, the *Visigoths* being softened by the Latins from *Westerogoths*, or those who inhabited the western part of Scandinavia, as the Ostrogoths were those who inhabited the eastern part of that country. Their history affords nothing of moment till the time of their quarrelling with the Romans; which happened under the reign of the emperor Caracalla, son to Severus. After that time their history

tory becomes so closely interwoven with that of the Romans, that for the most remarkable particulars of it we must refer to the article ROME. After the destruction of the Roman empire by the Heruli, the Ostrogoths, under their king Theodoric, became masters of the greatest part of Italy, having overcome and put to death Odoacer king of the Heruli in 494. They retained their dominion in this country till the year 553; when they were finally conquered by Narses, the emperor Justinian's general. See (History of) ITALY. The Visigoths settled in Spain in the time of the emperor Honorius, where they founded a kingdom which continued till the country was subdued by the Saracens. See SPAIN.

The Goths were famous for their hospitality and kindness to strangers, even before they embraced the Christian religion. Nay, it is said, that from their being eminently good, they were called *Goths*, by the neighbouring nations; that name, according to Grotius and most others writers, being derived from the German word *goten*, which signifies "good." They encouraged, says Dio, the study of philosophy above all other barbarous or foreign nations, and often chose kings from among their philosophers. Polygamy was not only allowed but countenanced among them; every one being valued or respected according to the number of his wives. By so many wives they had an incredible number of children, of whom they kept but one at home, sending out the rest in quest of new settlements; and hence those swarms of people which overran so many countries. With them adultery was a capital crime, and irremissibly punished with death. This severity, and likewise polygamy, prevailed among them when they were known to the Romans only by the name of *Getæ* (their most ancient name); as appears from the poet Menander, who was himself one of that nation; and from Horace, who greatly commends the chastity of their women. Their laws fell little short of those of the ancient Romans. Their government was monarchical; their religion was much the same with that of the ancient Germans or Celtes; and their dress is described by Apollinaris Sidonius in the following words: "They are shod (says he) with high shoes made of hair, and reaching up to their ankles; their knees, thighs, and legs, are without any covering; their garments of various colours scarce reaching to the knee; their sleeves only cover the top of their arms; they wear green cassocks with a red border; their belts hang on their shoulders; their ears are covered with twisted locks; they use hooked lances and missile weapons."

END OF THE NINTH VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. IX.

PART I.

PART II.

DIRECTIONS for PLACING the PLATES in Vol. IX.

Part I.

[illegible]

Part II.

[illegible]